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MP MASTER
MA32816

STEREO TAPE RECORD-PLAYBACK PREAMP

83 YU 916

ASSEMBLY MANUAL

A PRODUCT OF ALLIED RADIO · CHICAGO

knight-kit®

STEREO TAPE
RECORD-PLAYBACK PREAMP

Your new Knight-Kit is a complete and versatile stereo record-playback preamplifier in a single compact unit. An examination of the specifications and control functions immediately reveals the exceptional performance and versatility of the Knight Tape Record-Playback Preamp.

Professional-type features include a flexible front panel switch which allows "sound-on-sound" recordings and an "echo-chamber" effect to be added during recording.

Additional features are dual VU meters for independent level monitoring of both channels and clutch gain controls to provide convenient level adjustments.

Accessories which are available separately include a Stereo Tape Transport (KN-4000), a metal case, and a portable case.

CONSTRUCTION HINTS

UNPACKING

☐ If you are not familiar with electronic parts, we suggest that you check each part against the parts list in the rear of the manual. If you are unable to identify some of the parts, find their pictures on the wiring illustrations or on the parts identification chart. As you check off the parts, assort them so they are readily available. You may find it advantageous to sort the hardware (screws, nuts, lockwashers, etc.) into suitable containers. This step will acquaint you with various parts and thus simplify building.

HELPFUL CONSTRUCTION HINTS

This book uses some symbols to give the value of the parts. "Ω" means ohm, "K" means one thousand ohms, "meg" means one million ohms, μf means microfarad and μμf means micromicrofarad. Capacitor markings may be μf or MF for microfarad, μμf or MMF micromicrofarad.

Several types of wire are supplied. It is important to use the wire called for in the building step.

Insulated solid wire, identified by color, has been cut to length and prestripped for your convenience. Use only the color given in the step.
The construction of this kit will require the use of a soldering iron, rated at about 100 watts, a pair of long-nose pliers, a pair of diagonal cutters and a screwdriver.

Follow the step-by-step instructions exactly. DO NOT ATTEMPT TO WIRE THIS KIT FROM THE PICTORIALS OR SCHEMATIC DIAGRAM ALONE because a definite wiring sequence must be followed. Occasionally several parts are mounted with the same hardware, so be sure to read the entire step. Check off each step after you have completed it.

The leads from electrical components must be held in place by good mechanical connections. A lead held in place by solder alone is a potential source of trouble.

To make a good mechanical connection, insert the end of the lead through the hole in the terminal; wrap the lead around the terminal and cut off the excess wire. Clamp the connection with your long-nose pliers. Figure 1 illustrates a connection that has been properly made.

Flexible tubing is used to cover bare wire or leads where there is a chance they may touch other bare wires or the chassis. BARE WIRES AND BARE LEADS NOT CONNECTED TO THE SAME TERMINAL MUST NOT ACCIDENTALLY TOUCH EACH OTHER OR THE CHASSIS.

MOUNTING PARTS ON THE PRINTED CIRCUIT BOARD

Two printed circuit boards have been supplied. One is for the Playback section; the other one for the Record section.

Examine both sides of the printed circuit boards. Components are mounted on the side of the board that has the outline of the parts. The other side of the board is the foil side, etched to form the desired wiring pattern. Leads, terminals and tube pins are soldered to the foil as shown in Figure 1.

CAUTION: There are many closely-spaced strips of foil in the wiring pattern. When you are soldering parts to the board, be very careful not to short together separate strips. Shorts will make the unit inoperative, and may cause damage to some of the parts.

To mount resistors, first bend the leads close to the body. Insert the leads in the mounting holes and pull through until the part is close to the board. Bend the leads or terminals of each part flat against the foil side of the board to hold the part in place. Leads near the edges of the board should be bent towards the center.

HOW TO CARE FOR YOUR SOLDERING IRON

Before you start to solder, carefully clean the tip of your soldering iron with a fine file, or with steel wool, until the bright metal surface of the tip is exposed. Heat the iron; then cover (tin) the tip with a thin layer of ROSIN CORE SOLDER. While the iron is hot, remove excess solder from the tip by wiping with a clean cloth.

When the tip of the iron becomes covered with a dull, oxide film, wipe the tip with a clean cloth, and re-tin the iron.

To transfer the full heat of the iron, hold its greatest tip surface to the connection.

Never use the iron like a brush—soldering is not a paste-spreading operation.

THIS KIT MUST BE *PROPERLY* SOLDERED!

WITHOUT GOOD SOLDERING, AN ELECTRONIC UNIT WILL NOT WORK . . . just as a suit of clothing will fall apart if the stitches are loose . . . no matter how excellent the material.

USE ENOUGH HEAT

This is the main idea of good soldering. The purpose of soldering is to join metal parts, making an UNBROKEN metal path over which electricity can travel. To do this you must apply enough heat to the metal surfaces to make the solder spread freely on them, until the contour (shape) of the connection shows under the solder. If the solder barely melts and forms a rounded ball, *you are not using enough heat.* If you do not use enough heat, there may be no electrical connection, although it appears soldered.

HERE'S HOW TO DO IT . . .

1. Join bare metal to bare metal. Insulation must be removed.

2. Coat the tip of a hot iron with solder.

3. FIRMLY PRESS THE FLAT SIDE OF THE TIP OF A HOT IRON FLAT against the parts to be soldered together. Keep it there while you apply the solder BETWEEN THE IRON TIP AND THE METAL TO BE SOLDERED. Use only enough solder for it to flow over ALL the surfaces of the connection. Remove the iron.

4. DO NOT MOVE PARTS UNTIL THE SOLDER HARDENS. If you accidentally move the wires as the solder is hardening, apply your iron and reheat.

Compare your soldering with the pictures on this page. You have a good connection if your solder has flowed over all surfaces to be connected, following the shape of the surfaces. It should appear smooth and bright.

YOU HAVE NOT USED ENOUGH HEAT: If your connection is rough and flaky-looking, or if the solder has formed a round ball instead of spreading.

The difference between good soldering (enough heat) and poor soldering (not enough heat,) is just a few extra seconds with a hot iron FIRMLY applied. Remember, larger metal surfaces take a longer time to heat.

USE A 100-WATT IRON

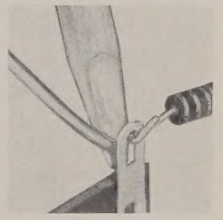
A 100-watt soldering iron with a clean, chisel-shaped tip will supply the right amount of heat when used correctly. Notice how the iron is held in the picture. Heat the iron for 10 minutes before you start soldering. Keep the tip brightly coated with solder. When necessary, wipe the hot tip clean with a cloth. (If you use a soldering gun, be sure the tip reaches full heat before you solder.)

USE ONLY ROSIN CORE SOLDER

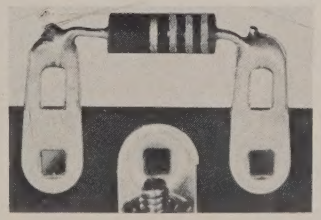
We supply the right kind of solder *(rosin core solder).* Do not use any other kind of solder! USE OF ACID CORE SOLDER, PASTE, OR IRONS CLEANED ON A SAL AMMONIAC BLOCK WILL RUIN ANY ELECTRONIC UNIT AND WILL VOID THE GUARANTEE.

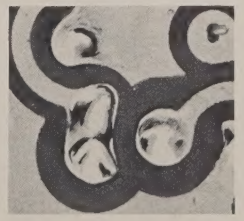
1. Join bare metal to bare metal

2. Press FLAT side of a HOT iron



3. Apply solder BETWEEN iron and connection





Compare your soldering with these pictures.

FIGURE 1. THE ONE-TWO-THREE OF GOOD SOLDERING.

PARTS MOUNTING-PLAYBACK CIRCUIT BOARD

SEE FIGURE 2 FOR LOCATION OF PARTS.

The PLAYBACK circuit board can be identified by the tube numbers V-1, V-2, V-3 and V-4, stamped on the board.

- ☐ 1¾" Bare wire and 1¼" black tubing. Place the tubing over the wire. Insert the ends of the wire in the holes marked JUMPER near CR-1.
- ☐ 1¾" Bare wire and 1¼" black tubing. Place the tubing over the wire. Insert the ends of the wire in the holes marked JUMPER near CR-2.
- ☐ CR-1, diode. Mount end with band in position shown.
- ☐ CR-2, diode. Mount end with band in position shown.
- ☐ V-1, V-2, V-3, V-4, 9 pin tube sockets with center pin and shield clip. Mount to the board by pressing the pins firmly into the mounting holes. Sockets do not fit flush to the board.

NOTE: Use solder sparingly when soldering tube socket pins. Solder can collect at the top of the tube socket and short the tube during operation.

- ☐ Turn the circuit board over and solder all tube socket pins, jumper connections and diodes to the foil. USE HEAT SPARINGLY WHEN SOLDERING CR-1 AND CR-2 TO PREVENT POSSIBLE DAMAGE. Clip off excess lead lengths.

Resistors and capacitors are to be mounted next. For convenience they are divided into groups. Each group will first be mounted, then soldered. Before mounting resistors and capacitors, bend the leads close to the body of the part. Leads near the edges of the circuit board should be bent toward the center of the board. After soldering, clip off excess lead lengths close to the foil.

- ☐ R-13, 18K (brown, gray, orange)
- ☐ R-22, 18K (brown, gray, orange)
- ☐ R-8, 33K (orange, orange, orange)
- ☐ R-27, 33K (orange, orange, orange)
- ☐ R-15, 47K (yellow, violet, orange)
- ☐ R-19, 47K (yellow, violet, orange)
- ☐ R-14, 1 meg (brown, black, green)
- ☐ R-21, 1 meg (brown, black, green)
- ☐ R-16, 680 Ω (blue, gray, brown)
- ☐ R-20, 680 Ω (blue, gray, brown)

- ☐ R-10, 22K (red, red, orange)
- ☐ R-26, 22K (red, red, orange)
- ☐ R-12, 3.9K (orange, white, red)
- ☐ R-23, 3.9K (orange, white, red)
- ☐ R-11, 1.3K (brown, orange, red, gold)

- ☐ R-24, 1.3K (brown, orange, red, gold)
- ☐ C-9, .05μf disc capacitor
- ☐ C-14, .05μf disc capacitor
- ☐ R-9, 1 meg (brown, black, green)
- ☐ R-25, 1 meg (brown, black, green)

- ☐ C-6, .05μf disc capacitor
- ☐ C-17, .05μf disc capacitor
- ☐ C-3, 780 μμf mica capacitor
- ☐ C-19, 780 μμf mica capacitor
- ☐ R-5, 75K (violet, green, orange, gold)
- ☐ R-30, 75K (violet, green, orange, gold)
- ☐ R-7, 200K (red, black, yellow, gold) or (200K)
- ☐ R-28, 200K (red, black, yellow, gold) or (200K)
- ☐ C-4, .05μf disc capacitor
- ☐ C-18, .05μf disc capacitor

- ☐ R-93, 200K (red, black, yellow, gold)
- ☐ R-94, 200K (red, black, yellow, gold)
- ☐ R-98, 1K (brown, black, red, gold)
- ☐ R-99, 1K (brown, black, red, gold)
- ☐ R-4, 2K (red, black, red, gold)
- ☐ R-31, 2K (red, black, red, gold)
- ☐ R-2, 1 meg (brown, black, green)
- ☐ R-32, 1 meg (brown, black, green)
- ☐ C-1, 47 μμf disc capacitor
- ☐ C-22, 47 μμf disc capacitor

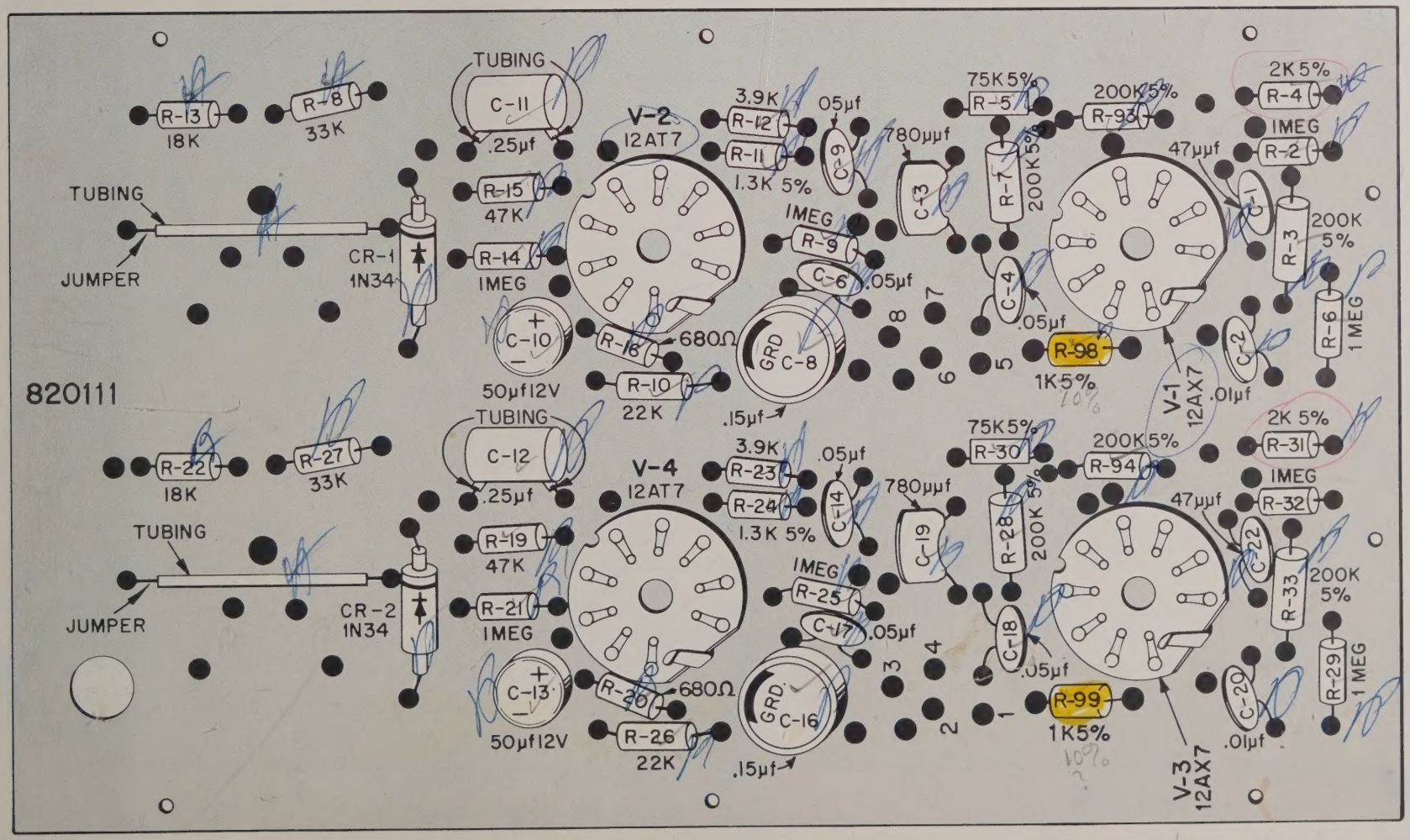
- ☐ R-3, 200K (red, black, yellow, gold) or (200K)
- ☐ R-33, 200K (red, black, yellow, gold) or (200K)
- ☐ C-2, .01μf disc capacitor (may be stamped 10,000 or 10K)
- ☐ C-20, .01μf disc capacitor
- ☐ R-6, 1 meg (brown, black, green)
- ☐ R-29, 1 meg (brown, black, green)
- ☐ C-11, .25μf (large capacitor). Place a ¼" length of black tubing over each lead. Solder.
- ☐ C-12, .25μf (large capacitor). Place a ¼" length of black tubing over each lead. Solder.
- ☐ C-10, 50μf Stand up type. Mount with markings as shown. Solder.
- ☐ C-13, 50μf Stand up type. Mount wtih markings as shown. Solder.

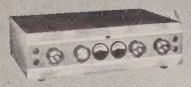
- ☐ C-8, .15μf Stand up type. Mount with GRD marking as shown. Solder.
- ☐ C-16, .15 μf Stand up type. Mount with GRD marking as shown. Solder.

Check the foil side for unsoldered connections and solder bridges between foil strips.

C-5 and C-21, capacitors in aluminum cans, will be mounted later.

FIGURE 2.


820111
TUBING
C-11
.25µf
R-13
18K
R-8
33K
R-15
47K
R-14
1MEG
C-10
50µf12V
R-18
680Ω
R-10
22K
V-2
12AT7
3.9K
R-12
R-11
1.3K 5%
.05µf
C-9
780µµf
C-13
IMEG
R-9
C-6
.05µf
GRD
C-8
.15µf
75K5%
R-5
R-7
200K5%
C-4
.05µf
R-98
1K5%
200K5%
R-93
47µµf
C-1
2K5%
R-4
IMEG
R-2
R-3
200K
5%
R-6
1MEG
C-2
.01µf
V-1
12AX7
TUBING
JUMPER
CR-1
1N34
R-22
18K
R-27
33K
C-12
.25µf
R-19
47K
R-21
1MEG
C-13
50µf12V
R-20
680Ω
R-26
22K
V-4
12AT7
3.9K
R-23
R-24
1.3K 5%
.05µf
C-14
780µµf
C-19
IMEG
R-25
C-17
.05µf
GRD
C-16
.15µf
75K5%
R-30
R-28
200K5%
C-18
.05µf
R-99
1K5%
200K5%
R-94
47µµf
C-22
2K 5%
R-31
IMEG
R-32
R-33
200K
5%
R-29
1MEG
C-20
.01µf
V-3
12AX7
TUBING
JUMPER
CR-2
1N34



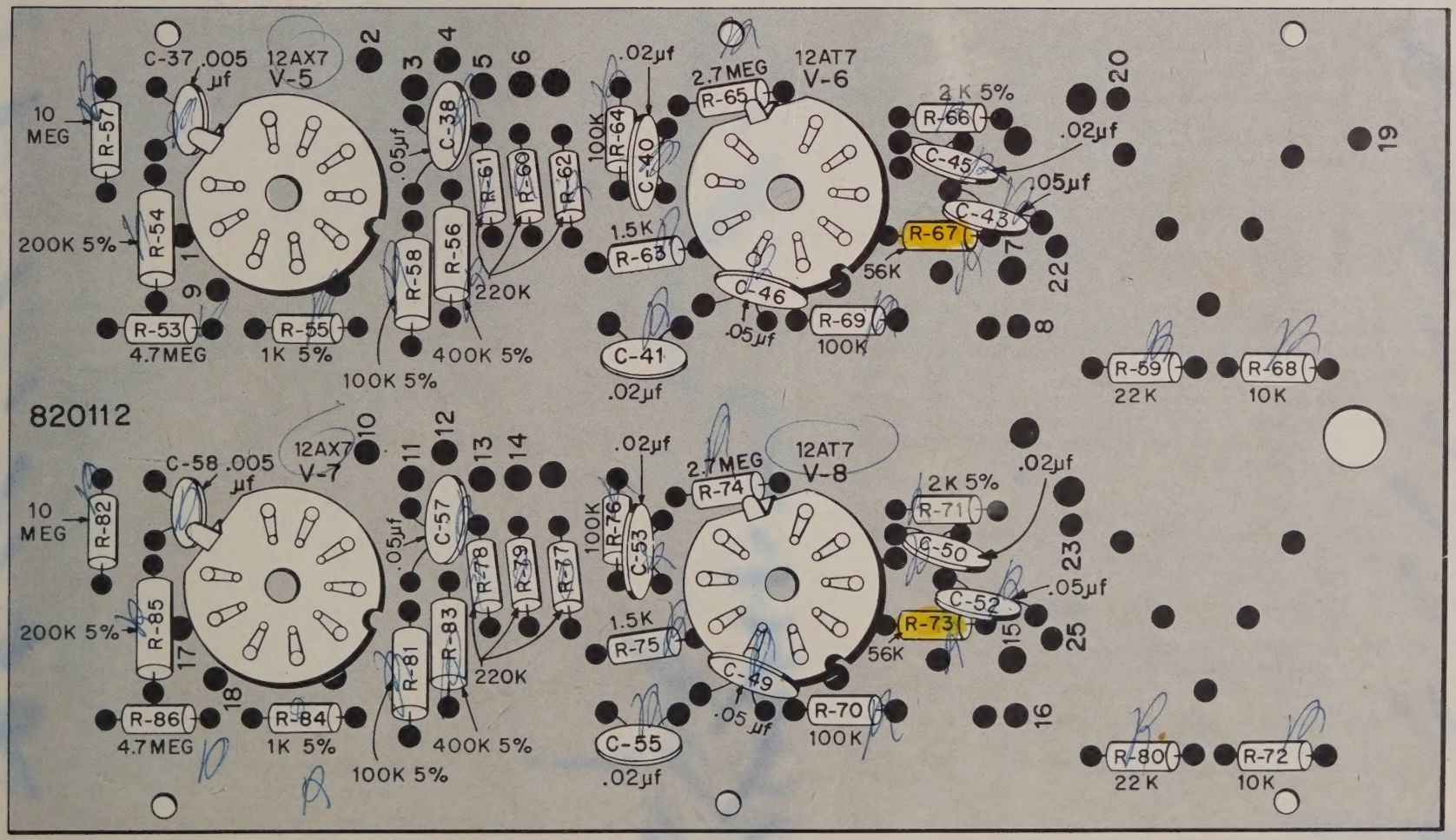
PARTS MOUNTING-RECORD CIRCUIT BOARD

SEE FIGURE 3 FOR LOCATION OF PARTS.

Wire this circuit board in the same manner as you did the PLAYBACK circuit board.

- ☐ 9 pin tube sockets with center pin and shield clips for V-5, V-6, V-7 and V-8.
- ☐ Turn the circuit board over and solder all the tube socket pins, including the center pins.
- ☐ R-57, 10 meg (brown, black blue)
- ☐ R-82, 10 meg (brown, black, blue)
- ☐ R-54, 200K (red, black, yellow, gold) or (200K)
- ☐ R-85, 200K (red, black, yellow, gold) or (200K)
- ☐ C-37, .005μf disc capacitor
- ☐ C-58, .005μf disc capacitor
- ☐ R-53, 4.7 meg (yellow, violet, green)
- ☐ R-86, 4.7 meg (yellow, violet, green)
- ☐ R-55, 1K (brown, black, red, gold)
- ☐ R-84, 1K (brown, black, red, gold)
- ☐ R-58, 100K (brown, black, yellow, gold) or (100K)
- ☐ R-81, 100K (brown, black, yellow, gold) or (100K)
- ☐ R-56, 400K (yellow, black, yellow, gold) or (400K)
- ☐ R-83, 400K (yellow, black, yellow, gold) or (400K)
- ☐ C-38, .05μf disc capacitor
- ☐ C-57, .05μf disc capacitor
- ☐ R-61, 220K (red, red, yellow)
- ☐ R-78, 220K (red, red, yellow)
- ☐ R-60, 220K (red, red, yellow)
- ☐ R-79, 220K (red, red, yellow)
- ☐ R-62, 220K (red, red, yellow)
- ☐ R-77, 220K (red, red, yellow)
- ☐ C-41, .02μf disc capacitor
- ☐ C-55, .02μf disc capacitor
- ☐ C-46, .05μf disc capacitor
- ☐ C-49, .05μf disc capacitor
- ☐ R-63, 1.5K (brown, green, red)
- ☐ R-75, 1.5K (brown, green, red)
- ☐ R-64, 100K (brown, black, yellow)
- ☐ R-76, 100K (brown, black, yellow)
- ☐ C-40, .02μf disc capacitor
- ☐ C-53, .02μf disc capacitor
- ☐ R-65, 2.7 meg (red, violet, green)
- ☐ R-74, 2.7 meg (red, violet, green)
- ☐ R-69, 100K (brown, black, yellow)
- ☐ R-70, 100K (brown, black, yellow)
- ☐ R-66, 2K (red, black, red, gold)
- ☐ R-71, 2K (red, black, red, gold)
- ☐ C-45, .02μf disc capacitor
- ☐ C-50, .02μf disc capacitor
- ☐ C-43, .05μf disc capacitor
- ☐ C-52, .05μf disc capacitor
- ☐ R-67, 56K (green, blue, orange)
- ☐ R-73, 56K (green, blue, orange)
- ☐ R-59, 22K (red, red, orange)
- ☐ R-80, 22K (red, red, orange)
- ☐ R-68, 10K (brown, black, orange)
- ☐ R-72, 10K (brown, black, orange)

FIGURE 3.


820112
C-37 .005 µf
12AX7 V-5
10 MEG
R-57
200K 5%
R-54
R-53 4.7MEG
R-55 1K 5%
100K 5%
.05µf
C-38
R-58
R-56
R-61
R-60
R-62
220K
400K 5%
.02µf
100K
R-64
C-40
1.5K
R-63
C-41 .02µf
2.7MEG
R-65
12AT7 V-6
C-46 .05µf
R-69 100K
2K 5%
R-66
.02µf
C-45
.05µf
C-43
R-67
56K
R-59 22K
R-68 10K
C-58 .005 µf
12AX7 V-7
R-82
R-85
R-86 4.7MEG
R-84 1K 5%
R-81
R-83
R-78
R-79
R-77
R-76
C-53
R-74
R-71
C-50
R-73
R-75
C-49 .05 µf
R-70 100K
C-55 .02µf
R-80 22K
R-72 10K

PARTS MOUNTING-BOTTOM

SEE FIGURE 4 ON SEPARATE SHEET.

☐ J-11, 3-terminal jack. Mount from **outside** the chassis. See Figure 5. Position the chassis as shown and place the ⅝″ grip nut on J-11 so the lip on the edge of the nut is facing up. Place a tube shield over the nut and with your long-nose pliers, apply an even downward pressure at the top of the tube shield until the grip nut is snug against the inside surface of the chassis.

☐ Two white pin jacks (J-5 and J-6). Mount to the **inside** of the chassis so the short terminal on both jacks touch each other. Fasten each jack with two 4-40 x ¼″ screws, lockwashers and nuts.

☐ Two yellow pin jacks (J-7 and J-8). Mount to the **inside** of the chassis in the same manner as you did the two white jacks. Make sure the short terminals touch each other. Fasten each jack with two 4-40 x ¼″ screws, lockwashers and nuts.

☐ Two red pin jacks (J-9 and J-10). Similarly mount these jacks to the **inside** of the chassis. Fasten each jack with two 4-40 x ¼″ screws, lockwashers and nuts.

☐ R-41, 25K control. (Screwdriver slot in shaft), and ¼″ lockwasher. ~~See Figure 5.~~ Place the lockwasher over the shaft of R-41 so the teeth point toward the control. Insert the shaft through its mounting hole from the **inside** of the chassis. Position the terminals as shown and fasten with a ¼″ nut.

☐ Solder lug. Fasten to the **outside** of the chassis between J-4 and J-5 with a #4 self tapping screw.

☐ Two ⅜″ grommets. Insert in the mounting holes near TS-2, and TS-3.

☐ ¼″ grommet. Insert in the hole near TS-9.

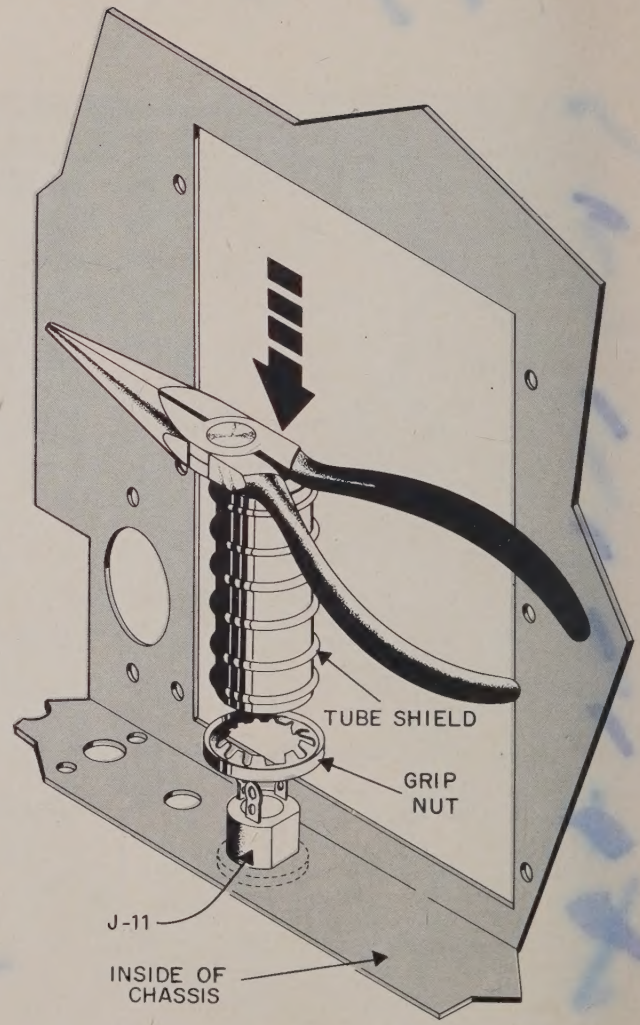


FIGURE 5.

☐ T-1, power transformer. Mount on **top** of the chassis. Feed the green and black leads through the ⅜″ grommet at the back of the chassis. Feed the red and yellow leads through the grommet near TS-3. From the top of the chassis, insert a 6-32 x ¼″ screw in the mounting hole indicated. Fasten with a lockwasher and nut.

☐ TS-2, 2-terminal strip. Insert a 6-32 x ¼″ screw through the appropriate mounting tab on T-1. Place TS-2 over the screw and fasten with a lockwasher and nut.

☐ TS-1, 2-terminal strip. Mount in similar manner as TS-2.

☐ TS-3, 3-terminal strip. Mount in similar manner as TS-2.

☐ TS-4, 4-terminal strip. Fasten with a 6-32 x ¼″ screw, lockwasher and nut.

☐ AC-2, 110 volt receptacle. Mount from **inside** the chassis. Fasten with two 6-32 x ⅜″ screws, lockwashers and nuts.

☐ RECORD printed circuit board. Mount to the **inside** of the chassis. Place the board over the large opening in the middle of the chassis with the foil side up and tube sockets V-5 and V-7 toward the front. Fasten with four 4-40 x ¼″ screws and nuts in the holes indicated. The remaining two holes will receive screws later.

☐ PLAYBACK printed circuit board. Mount to the **inside** of the chassis with the foil side up and V-1 and V-3 tube sockets toward the back of the chassis. Fasten the outer edge of the board (without foil) with three 4-40 x ¼″ screws and nuts. The inside edge will be fastened later.

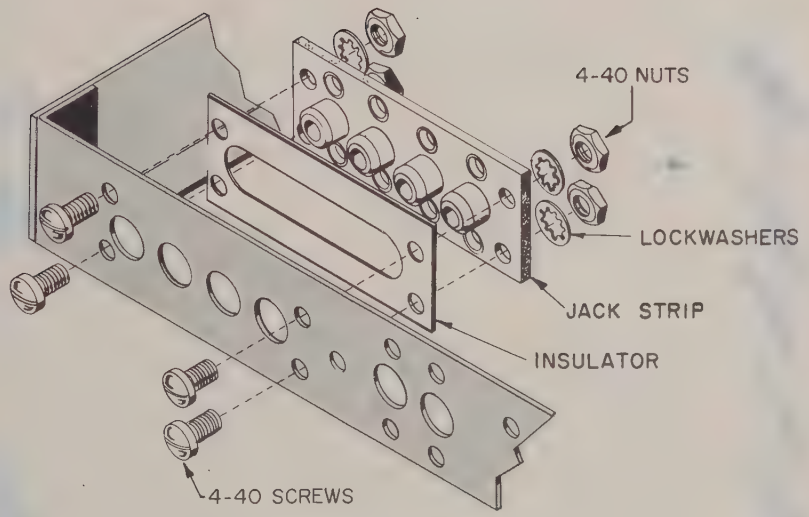


FIGURE 6.

☐ Pin jack strip (J-1, J-2, J-3 and J-4) and insulator. See Figure 6. Place the insulator over the face of the jack strip. Mount to the **inside** of the chassis. Fasten with four 4-40 x ¼″ screws, lockwashers and nuts.

☐ ⅜″ grommet. Mount in the shield (rectangular shaped with notch).

☐ Shield. Mount to the **inside** of the chassis between J-6 and J-7. Fasten with two 4-40 x ¼″ screws, lockwashers and nuts.

☐ Phenolic stand-off. Insert a 6-32 x ¼″ screw from the top of the RECORD circuit board and thread the stand-off on the screw.

PARTS MOUNTING-BOTTOM

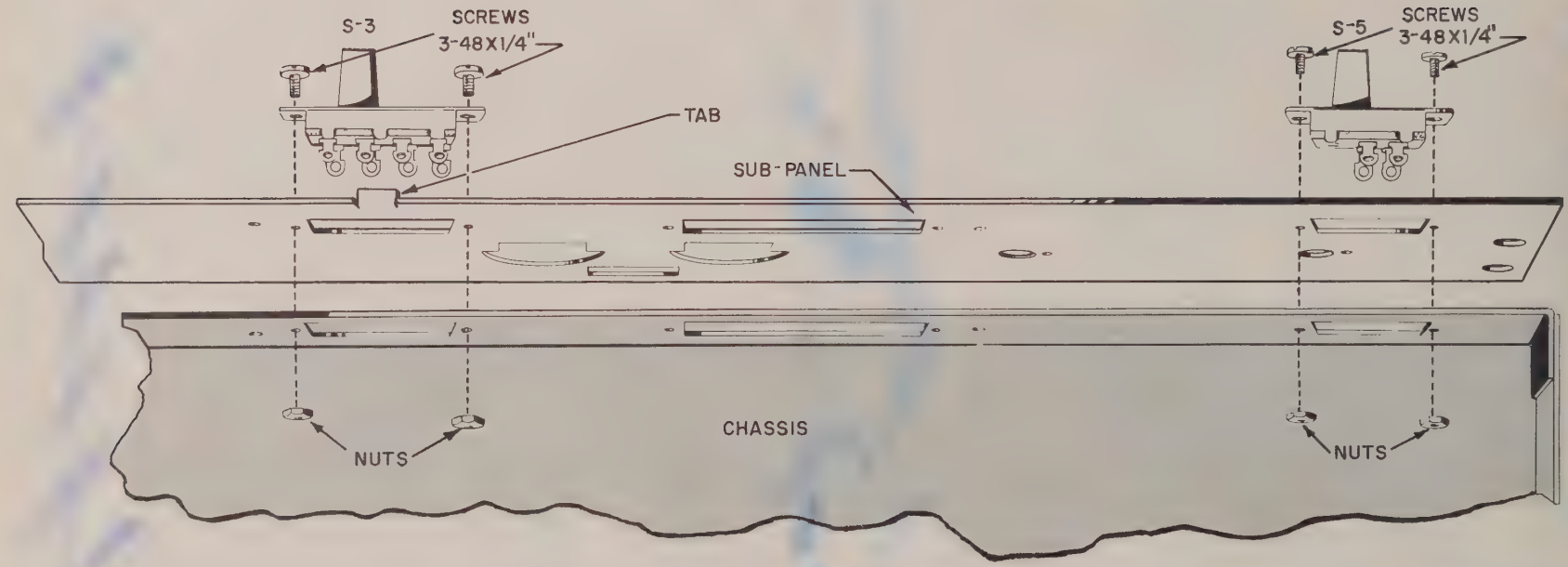


FIGURE 7.

☐ S-3, 8-terminal switch and sub-panel. See Figure 7. Position the sub-panel over the front of the chassis so the rectangular holes in both parts are in line. Make sure the tab on the sub-panel is facing away from the chassis. Mount S-3 to the **front** of the sub-panel. Fasten all three parts with two 3-48 x ¼" screws and nuts. DO NOT TIGHTEN NUTS.

☐ S-5, 4-terminal switch. See Figure 7. Mount to the **front** of the sub-panel. Position the terminals as shown and fasten with two 3-48 x ¼" screws and nuts. DO NOT TIGHTEN NUTS.

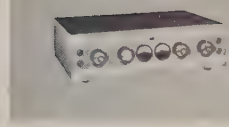
☐ S-2, two section switch with 12 terminals. See Figure 4. Mount to the **front** of the sub-panel with the plastic push button closer to S-3. Fasten with two 3-48 x ¼" screws and nuts. DO NOT TIGHTEN NUTS.

☐ S-4, two section switch with 12 terminals. Mount to the **front** of the sub-panel with the plastic push button closer to S-5. Fasten with two 3-48 x ¼" screws and nuts. DO NOT TIGHTEN NUTS.

☐ TS-5, 1-terminal strip. Mount to the inside of the chassis near S-3. Fasten with a 6-32 x ¼" screw, lockwasher and nut. DO NOT TIGHTEN NUT.

☐ TS-6, 1-terminal strip. Mount to the inside of the chassis near S-4. Fasten with a 6-32 x ¼" screw, lockwasher and nut. TIGHTEN ALL THE NUTS ON THE TERMINAL STRIPS AND SWITCHES.

☐ TS-7, 4-terminal strip. Fasten with a 6-32 x ¼" screw, lockwasher and nut.



☐ TS-8, 4-terminal strip. Fasten with a 6-32 x ¼" screw, lockwasher and nut.

☐ V-9, 9 pin tube socket and shield saddle. Mount the socket from the **inside** of the chassis with the keyway facing the back of the chassis. (The keyway is the wide space between two of the terminals.) Mount the shield saddle on **top** of the chassis. Line up the mounting holes and fasten with two 3-48 x ¼" screws, lockwashers and nuts.

☐ L-5, Bias oscillator (can with three leads). Mount to the top of the chassis so the side with the leads is toward the back of the chassis. Feed the lead through the hole. Fasten the can with two 4-40 nuts and lockwashers. Be careful not to pinch the leads when you tighten the nuts.

☐ TS-9, 3-terminal strip and TS-10, 5-terminal strip. Both these parts are mounted with the same screw. TS-10 mounts on top of the chassis; TS-9 mounts on the bottom. See Figure 8 for positioning of TS-10. Fasten with a 6-32 x ¼" screw, lockwasher and nut.

☐ Two capacitor mounting plates. Mount a plate over each of the two large circular holes on **top** of the chassis. Fasten each one with two 6-32 x ¼" screws, lockwashers and nuts.

☐ Violet wire. Solder one end in hole A of the RECORD circuit board. Connect the other end to terminal 2 of TS-7. Do not solder this terminal.

☐ F-1, Fuse holder with hardware. Place the rubber washer over the threaded end of F-1. Insert F-1 through its mounting hole from the **outside** of the chassis; place the lockwasher and nut over F-1; position the terminals and tighten the nut.

IMPORTANT INSTRUCTIONS

CONNECT **means:** Connect the wire or lead to the given point. Make a firm mechanical connection BUT DO NOT SOLDER AT THIS TIME. Later another wire(s) will be connected to this point.

SOLDER **means:** Connect the wire or lead to the given point and then SOLDER THE CONNECTION AND ALL WIRES IN IT. If there is more than one wire in the connection, the number of wires will be stated. For example, if the building step tells you to **"solder the shield wire to the solder lug (4 wires),"** it means there should be four wires connected to that solder lug when you solder it. If you do not have the stated number of wires you have made an error. Go back and check your work.

Eight leads from T-1:

☐ Connect the longer red lead to terminal 4 of TS-8.

☐ Connect the shorter red lead to terminal 1 of TS-1.

☐ Connect one of the yellow leads to terminal 1 of TS-4.

☐ Connect the remaining yellow lead to terminal 4 of TS-4.

☐ Connect one of the green leads to terminal 1 of TS-2.

☐ Connect the remaining green lead to terminal 2 of TS-2.

☐ Connect the shorter black lead to terminal 2 of AC-2.

☐ Solder the longer black lead to terminal 2 of F-1.

Three leads from L-5:

☐ Connect the red lead to terminal 2 of TS-9.

☐ Connect the black lead to pin 1 of V-9.

☐ Connect the blue lead to pin 6 of V-9.

PARTS MOUNTING-TOP

SEE FIGURE 8 ON SEPARATE SHEET.

☐ TS-11, 2 terminal strip. Mount to the inside of the sub-panel just below the rectangular hole. Fasten with a 6-32 x ¼" screw, lockwasher and nut.

☐ Pilot light socket #1. Mount to the inside of the sub-panel at a downward angle of 45°. Fasten with a 6-32 x ¼" screw, lockwasher and nut.

☐ Pilot light socket #2 and solder lug. Mount to the inside of the sub-panel so it faces socket #1 at a downward angle of 45°. Fasten with a 6-32 x ¼" screw, solder lug and nut.

☐ R-52, 1 meg dual control (value stamped on part). Mount so the locating tab on the front of the control fits into the hole in the sub-panel. Fasten with a ⅜" nut.

☐ R-91, 250K dual control. Mount in same manner as R-52. Fasten with a ⅜" nut.

☐ R-92, 250K dual control. Mount in same manner as R-52. Fasten with a ⅜" nut.

☐ J-13, long phone jack and one fiber shoulder washer. See Figure 9. Place the shoulder washer in the lower 7/16" hole near R-52 on the inside of the sub-panel. Insert the threaded end of the jack through the washer from the inside of the panel. Fasten with a ⅜" nut. DO NOT USE A FLAT FIBERWASHER.

☐ J-15, long phone jack, one fiber shoulder washer and one flat fiber washer. Mount in the LOWER 7/16" diameter hole near R-92 in the same manner as J-13. Fasten with one flat fiber washer and ⅜" nut.

Temporarily attach the control panel (brass dress panel) to the sub-panel by threading a ⅜" nut over each of the dual controls. Operate the slide switches and note if any of them are binding. If so, remove the control panel —loosen and reposition the switch. Tighten the screws on the switch and replace the control panel. Check if the switch (or switches) is operating freely. Remove the control panel.

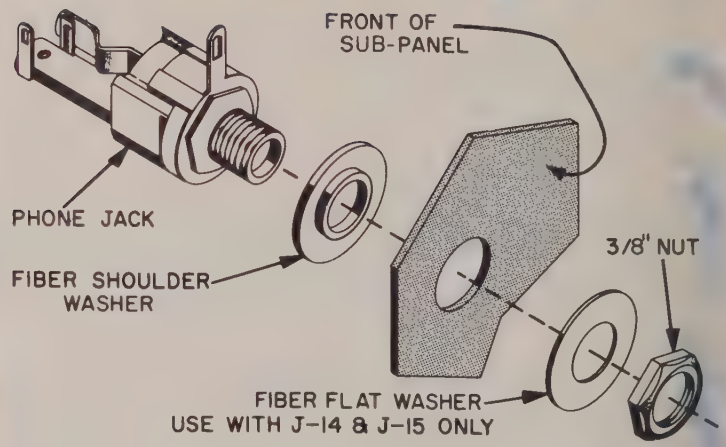


FIGURE 9.

FIRST WIRING-TOP

SEE FIGURE 10 ON SEPARATE SHEET.

☐ 1½" Thin bare wire. Solder one end to terminal 1 of J-15. Connect the other end to terminal 2.

☐ 6" Gray shielded cable. From the length of gray shielded single conductor cable supplied, cut a piece 6" long.

☐ SEE FIGURE 11 for cable preparation. From one end of the cable, remove ½" outer insulation. Unwind the spiral shield from around the inner conductor. Twist the strands together and lightly coat the tip with solder. Remove ¼" inner insulation and coat the inner conductor with solder. From the other end of the cable, remove 1" outer insulation and ¼" inner insulation. Coat the ends of the shield wire and inner conductor with solder.

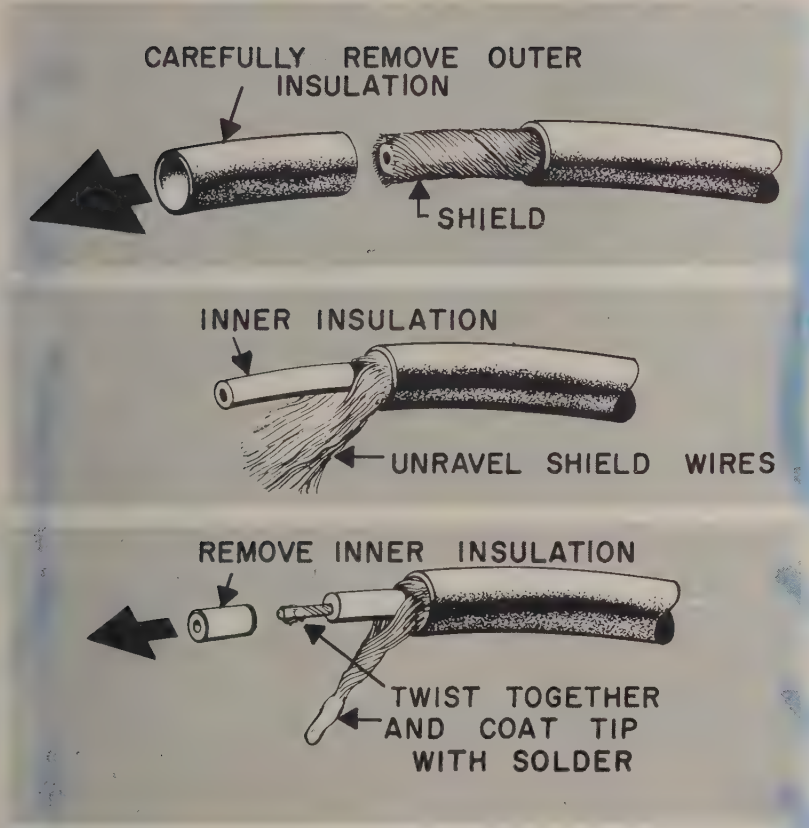


FIGURE 11.

NOTE: When soldering a shielded cable, keep the inner conductor at a straight angle to the terminal. If the inner conductor is curved or bent the insulation will separate from the wire when heat is applied.

☐ At the ½″ end of the cable, solder the inner conductor to terminal 3 of J-15. Solder the shield wire to terminal 2 (2 wires).

☐ At the 1″ end of the cable, insert the inner conductor in hole 18 of the RECORD circuit board. Place a ¾″ length of yellow tubing over the shield wire and insert the shield wire in hole 17. Turn the chassis over and solder these connections to the foil.

NOTE: When the shield wires are not mentioned in the preparation of a length of cable, it is understood that they will be twisted and coated with solder as shown in Figure 11. If the shield wire is to be removed at one end of the cable it will be so stated.

☐ 8″ Gray shielded cable and ¾″ length of yellow tubing. From one end of the cable, remove 1″ outer insulation and ¾″ inner insulation. From the other end of the cable, remove ½″ outer insulation and ¼″ inner insulation. Remove the shield wire at the ½″ end of the cable by cutting the strands close to the outer insulation.

☐ At the end of the cable WITH the shield wire, solder the inner conductor to terminal 3 of J-13. Place the ¾″ yellow tubing over the shield wire and solder the shield wire to terminal 2. Feed the free end of the cable through the large hole in the PLAYBACK circuit board. It will be connected later.

☐ 10½″ RED shielded cable. From one end of the cable, remove 1″ outer insulation and ¼″ inner insulation. From the other end of the cable, remove ½″ outer insulation and ¼″ inner insulation.

☐ At the 1″ end of the cable, solder the inner conductor to terminal 2 of R-92. Connect the shield wire to terminal 1.

☐ At the ½″ end of the cable, insert the inner conductor in hole 5 of the RECORD circuit board. Insert the shield wire in hole 4. Turn the chassis over and solder these connections to the foil.

FIRST WIRING-TOP

- ☐ 8½" GRAY shielded cable. Prepare this cable exactly as you did the 10½" red cable.
- ☐ At the 1" end of the cable, solder the inner conductor to terminal 5 of R-92. Connect the shield wire to terminal 4.
- ☐ At the ½" end of the cable, insert the inner conductor in hole 13 of the RECORD circuit board. Insert the shield wire in hole 12. Turn the chassis over and solder.
- ☐ 8½" RED shielded cable. From one end of the cable, remove 1" outer insulation and ¼" inner insulation. From the other end of the cable, remove ½" outer insulation and ¼" inner insulation. Remove the shield wire from the ½" end by cutting the strands close to the outer insulation.
- ☐ At the 1" end of the cable, solder the inner conductor to terminal 2 of R-91. Connect the shield wire to terminal 1.
- ☐ At the ½" end of the cable, insert the inner conductor in hole 6 of the RECORD circuit board. Turn the chassis over and solder.
- ☐ 6½" GRAY shielded cable. Prepare this cable exactly as you did the 8½" red cable.
- ☐ At the 1" end of the cable, solder the inner conductor to terminal 5 of R-91. Connect the shield to terminal 4.
- ☐ At the ½" end of the cable, insert the inner conductor in hole 14 of the RECORD circuit board. Turn the chassis over and solder.
- ☐ 7" RED shielded cable. From one end of the cable, remove 1" outer insulation and ¼" inner insulation. From the other end of the cable, remove ½" outer insulation and ¼" inner insulation.
- ☐ At the 1" end of the cable, solder the inner conductor to terminal 2 of R-52. Connect the shield wire to terminal 1.
- ☐ At the ½" end, insert the inner conductor in hole 8 of the PLAYBACK circuit board. Insert the shield wire in hole 7. Turn the chassis over and solder.
- ☐ 7½" RED shielded cable. From one end of the cable, remove 1¼" outer insulation and ¼" inner insulation. From the other end of the cable, remove ½" outer insulation and ¼" inner insulation.
- ☐ At the 1¼" end of the cable, connect the inner conductor to terminal 3 of R-52. Solder the shield wire to terminal 1 (2 wires).
- ☐ At the ½" end of the cable, insert the shield wire in hole 6 of the PLAYBACK circuit board. Insert the inner conductor in hole 5. Turn the chassis over and solder.
- ☐ R-17, 3K (orange, black, red, gold). Cut each lead to ¾". Connect one lead to terminal 5 of TS-10. Connect the other lead to terminal 4.
- ☐ R-18, 3K (orange, black, red, gold). Cut each lead to ¾". Connect one lead to terminal 1 of TS-10. Connect the other lead to terminal 2.
- ☐ Blue wire. Solder one end to terminal 5 of TS-10 (2 wires). Feed the free end through the square hole in the chassis. It will be connected later.
- ☐ Green wire. Solder one end to terminal 2 of TS-10 (2 wires). Feed the free end through the square hole in the chassis. It will be connected later.
- ☐ Neon bulb and two ½" lengths of black tubing. Place the tubing over the leads on the neon bulb. Solder one lead to terminal 1 of TS-11. Connect the other lead to terminal 2.

SEE FIGURE 12 ON SEPARATE SHEET.

J-12, short phone jack and a fiber shoulder washer. Mount in the hole above J-13. See Figure 9. Fasten with a ⅜" nut. DO NOT USE A FLAT FIBER WASHER.

☐ J-14, long phone jack, shoulder washer and flat fiber washer. Mount in the hole above J-15. Fasten with a flat fiber washer and a ⅜" nut.

☐ Red wire. Solder one end to terminal 1 of J-13. Solder the other end to terminal 3 of J-12. See headphone alternate wiring instructions on page 32.

☐ 8½" RED shielded cable and ½" length of yellow tubing. From one end of the cable, remove 1¼" outer insulation and ¼" inner insulation. From the other end of the cable, remove ½" outer insulation and ¼" inner insulation. Remove the shield wire at ½" end of the cable.

☐ At the 1¼" end of the cable, solder the inner conductor to terminal 1 of J-12. Slip the tubing over the shield wire and solder the shield wire to terminal 2.

☐ Feed the free end of the cable through the large hole in the PLAYBACK circuit board. It will be connected later.

☐ 7½" GRAY shielded cable. From one end of the cable, remove 1¼" outer insulation and ¼" inner insulation. From the other end of the cable, remove ½" outer insulation and ¼" inner insulation.

☐ At the 1¼" end of the cable, connect the inner conductor to terminal 6 of R-52. Connect the shield wire to terminal 4.

☐ At the ½" end of the cable, insert the center conductor in hole 1 of the PLAYBACK circuit board. Insert the shield wire in hole 4. Turn the chassis over and solder.

☐ 7" GRAY shielded cable. From both ends of the cable, remove ½" outer insulation and ¼" inner insulation.

☐ At one end of the cable, solder the inner conductor to terminal 5 of R-52. Solder the shield wire to terminal 4 (2 wires).

☐ At the other end of the cable, insert the inner conductor in hole 3 of the PLAYBACK circuit board. Insert the shield wire in hole 2. Turn the chassis over and solder.

☐ C-67, 200 $\mu\mu$f disc capacitor, and a ½" length of black tubing. See Figure 12, Detail A. Place the tubing over one of the leads. Solder this lead to terminal 3 of R-52 (2 wires). The other lead will be connected later.

☐ C-68, 200 $\mu\mu$f disc capacitor and a ½" length of black tubing. Place the tubing over one of the leads. Solder this lead to terminal 6 of R-52 (2 wires). The other lead will be connected later.

☐ TS-15, 3-terminal strip. Mount as shown in Figure 12, Detail A. Fasten with a 6-32 x ¼" screw, lockwasher and nut.

☐ L-8. Connect one lead to terminal 3 of TS-15. Connect the other lead to terminal 2.

☐ L-9. Connect one lead to terminal 1 of TS-15. Solder the other lead to terminal 2 (2 wires).

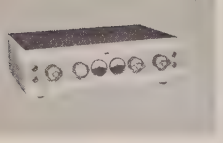
☐ Solder the free lead of C-68 to terminal 1 of TS-15 (2 wires).

☐ Solder the free lead of C-67 to terminal 3 of TS-15 (2 wires).

☐ 1½" thin bare wire. Solder one end to terminal 1 of J-14. Connect the other end to terminal 2.

☐ 9" RED shielded cable. From one end of the cable, remove 1" outer insulation and ¼" inner insulation. From the other end of the cable, remove ½" outer insulation and ¼" inner insulation.

☐ At the 1" end of the cable, solder the inner conductor to terminal 3 of J-14. Solder the shield wire to terminal 2 (2 wires).



WIRING SELECTOR SWITCH S-1

☐ At the ½" end of the cable, insert the inner conductor in hole 9 of the RECORD circuit board. Insert the shield wire in hole 1. Turn the chassis over and solder.

☐ 10½" RED shielded cable. From one end of the cable, remove 1¼" outer insulation and ¼" inner insulation. From the other end of the cable, remove ½" outer insulation and ¼" inner insulation.

☐ At the 1¼" end of the cable, solder the inner conductor to terminal 3 of R-92. Solder the shield wire to terminal 1 (2 wires).

☐ At the ½" end of the cable, insert the inner conductor in hole 3 of the RECORD circuit board. Insert the shield wire in hole 2. Turn the chassis over and solder.

☐ 8½" GRAY shielded cable. Prepare this cable exactly as you did the 10½" RED cable.

☐ At the 1¼" end of the cable, solder the inner conductor to terminal 6 of R-92. Solder the shield wire to terminal 4 (2 wires).

☐ At the ½" end of the cable, insert the inner conductor in hole 11 of the RECORD circuit board. Insert the shield wire in hole 10. Turn the chassis over and solder.

☐ Green wire. Solder one end to the terminal on pilot socket #1. Connect the other end to the terminal on pilot socket #2.

SEE FIGURE 13 ON SEPARATE SHEET.

The wafers on this switch are wired from the back beginning with the last wafer (C). To properly orient the switch, hold the switch so wafer C is facing you with the red dot appearing in the upper right. The terminals on the wafer are numbered clockwise beginning with the first terminal to the right of the top screw head. All wafers are numbered and wired in this manner. DISREGARD ANY TERMINAL NUMBERS THAT MAY BE STAMPED ON THE WAFERS.

NOTE: Use the small diameter black tubing and thin bare wire when wiring S-1.

WAFER C

☐ R-90, 100K resistor (brown, black, yellow). Cut each lead to ½". Connect one lead to terminal 1. Connect the other lead to terminal 2.

☐ 1¾" bare wire. Solder one end to terminal 2 (2 wires). The other end will be connected later.

☐ 1¼" bare wire and ¾" tubing. Place the tubing over the wire. Solder one end to terminal 1 (2 wires). Connect the other end to terminal 4.

☐ Red wire: Solder one end to terminal 4 (2 wires). The free end will be connected later.

☐ 1¼" Bare wire and ¾" tubing. Place the tubing over the wire. Solder one end to terminal 3. Connect the other end to terminal 5.

☐ 1" Bare wire and ½" tubing. Place the tubing over the wire. Solder one end to terminal 5 (2 wires). Connect the other end to terminal 6.

☐ 1" Bare wire and ½" tubing. Place the tubing over the wire. Connect one end to terminal 6. Connect the other end to terminal 7.

☐ 2" Bare wire. Solder one end to terminal 7 (2 wires). The free end will be connected later.

☐ 1¼" Bare wire. ¾" tubing. Place the tubing over the wire. Connect one end to terminal 8. Solder the other end to terminal 11.

☐ 3½" Black/white stranded wire. Solder one end to terminal 8 (2 wires). The free end will be connected later.

☐ Yellow wire. Solder one end to terminal 9. The free end will be connected later.

☐ 1" Bare wire and ½" tubing. Place the tubing over the wire. Solder one end to terminal 12. Connect the other end to terminal 13.

☐ 1" Bare wire and ½" tubing. Place the tubing over the wire. Connect one end to terminal 13. Connect the other end to terminal 14.

☐ 2" Bare wire and 1½" tubing. Place the tubing over the wire. Solder one end to terminal 14 (2 wires). Solder the other end to terminal 6 (3 wires).

☐ 1½" Bare wire. 1" tubing. Place the tubing over the wire. Solder one end to terminal 10. Solder the other end to terminal 13 (3 wires).

WIRING SELECTOR SWITCH S-1

WAFER B

- ☐ 1″ bare wire and ½″ tubing. Place the tubing over the wire. Connect one end to terminal 1. Connect the other end to terminal 3.
- ☐ R-89, 100K, (brown, black, yellow). Cut each lead to ½″. Solder one lead resistor to terminal 1 (2 wires). Connect the other lead to terminal 2.
- ☐ 1¾″ bare wire. Solder one end to terminal 2 (2 wires). The other end will be connected later.
- ☐ 1″ Bare wire and ½″ tubing. Place the tubing over the wire. Solder one end to terminal 4. Connect the other end to terminal 5.
- ☐ 1″ Bare wire and ½″ tubing. Place the tubing over the wire. Solder one end to terminal 5 (2 wires). Connect the other end to terminal 6.
- ☐ 1″ Bare wire and ½″ tubing. Place the tubing over the wire. Solder one end to terminal 6 (2 wires). Connect the other end to terminal 7.
- ☐ 1½″ Bare wire and 1″ tubing. Connect one end to terminal 7. Connect the other end to terminal 11.
- ☐ 2″ Bare wire. Solder one end to terminal 7 (3 wires). The free end will be connected later.
- ☐ 1″ Bare wire and ½″ tubing. Place the tubing over the wire. Connect one end to terminal 8. Solder the other end to terminal 10.
- ☐ 2½″ green/white stranded wire. Solder one end to terminal 8 (2 wires). The free end will be connected later.
- ☐ Yellow wire. Solder one end to terminal 9. The free end will be connected later.
- ☐ 1″ Bare wire and ½″ tubing. Place the tubing over the wire. Solder one end to terminal 11 (2 wires). Connect the other end to terminal 12.
- ☐ 1″ Bare wire and ½″ tubing. Place the tubing over the wire. Solder one end to terminal 12 (2 wires). Connect the other end to terminal 13.
- ☐ 1″ Bare wire and ½″ tubing. Place the tubing over the wire. Solder one end to terminal 13 (2 wires). Solder the other end to terminal 14.

WAFER A

- ☐ R-42, 100K (brown, black, yellow). Connect one lead to terminal 1. Connect the other lead to terminal 8.
- ☐ R-43, 100 Ω (brown, black, brown). Cut each lead to ½″. Connect one lead to terminal 1. Connect the other lead to terminal 2.
- ☐ C-30, .005μf. Place 1″ tubing over both leads. Solder one lead to terminal 1 (3 wires). Connect the other lead to terminal 7.
- ☐ Orange wire. Solder one end to terminal 2 (2 wires). The free end will be connected later.
- ☐ 1″ Bare wire and ½″ tubing. Place the tubing over the wire. Connect one end to terminal 5. Connect the other end to terminal 6.
- ☐ 1″ Bare wire and ½″ tubing. Place the tubing over the wire. Solder one end to terminal 6 (2 wires). Solder the other end to terminal 7 (2 wires).
- ☐ Violet wire. Solder one end to terminal 5 (2 wires). The free end will be connected later.
- ☐ Yellow wire. Solder one end to terminal 8 (2 wires). The free end will be connected later.
- ☐ 5½″ RED shielded cable. From one end of the cable, remove ½″ outer insulation and ¼″ inner insulation. Remove the shield wire at this end. From the other end of the cable, remove 1″ outer insulation and ¼″ inner insulation.
- ☐ At the 1″ end of the cable, connect the inner conductor to terminal 3. The shield wire will be connected later.
- ☐ 5½″ GRAY shielded cable. Prepare this cable exactly as you did the 5½″ red cable.
- ☐ At the 1″ end of the cable, connect the inner conductor to terminal 4. The shield wire will be connected later.
- ☐ 5½″ RED shielded cable. From both ends of the cable, remove ½″ outer insulation and ¼″ inner insulation. Remove the shield wire from one end.
- ☐ Solder the end of the cable WITHOUT the shield wire to terminal 3 (2 wires).

BACK COVER AND BRACKET ASSEMBLY

OA-7

☐ 4½" GRAY shielded cable. Prepare the cable exactly as you did the 5½" red cable.

☐ Solder the end of the cable WITHOUT the shield wire to terminal 4 (2 wires). The free ends of these four cables will be connected later.

☐ 1" bare wire and ½" tubing. Place the tubing over the wire. Connect one end to terminal 10. Solder the other end to terminal 9.

☐ Yellow wire. Solder one end to terminal 10 (2 wires). The other end will be connected later.

SEE FIGURE 14 ON SEPARATE SHEET.

☐ Back cover and R-105, 100K control. From the inside of the back cover, insert the shaft of the control through the top hole. Make sure the locating tab fits into the small hole. Fasten with a ¼" nut.

☐ R-104, 100K control. Similarly mount this control in the bottom hole of the back cover. Fasten with a ¼" nut.

☐ 6" Blue stranded wire. Solder one end to terminal 1 of R-105. The other end will be connected later.

☐ 6" White stranded wire. Solder one end to terminal 2 of R-105. The other end will be connected later.

☐ Red solid wire. Solder one end to terminal 3 of R-105. Connect the other end to terminal 3 of R-104.

☐ 2½"White/green stranded wire. Solder one end to terminal 3 of R-104 (2 wires). The other end will be connected later.

☐ 6" Green stranded wire. Solder to terminal 2 of R-104. The other end will be connected later.

☐ Brown stranded wire. Solder to terminal 1 of R-104.

☐ Bracket, six ¼" grommets and two ⅜" grommets. Mount the grommets in the holes of the bracket as shown.

☐ Two trimmer capacitors marked with YELLOW dot. Mount from the outside of the bracket. Position as shown and fasten each capacitor with a ¼" nut.

☐ Two trimmer capacitors marked with BLUE dot. Similarly mount these capacitors in the position shown and fasten with ¼" nuts.

☐ Four trimmer capacitors marked with RED dot. Mount as shown and fasten with ¼" nuts.

☐ Two phenolic stand-offs. Fasten each stand-off to the outside of the bracket with a 6-32 x ¼" screw.

☐ Blue solid wire. Pass the wire through the grommet near C-60. Solder one end to terminal 2 of C-60. The other end will be connected later.

NOTE: Be sure that solder flows through all the laminations on the terminals of the trimmer capacitors.

☐ Orange solid wire and yellow solid wire. Pass both wires through the grommet near C-61. Solder the orange wire to terminal 1 of C-61. Solder the yellow wire to terminal 2. The other ends of the wires will be connected later.

☐ 6" Brown/white stranded wire. Pass the wire through the grommet near C-62. Solder the wire to terminal 2 of C-62. The other end will be connected later.

☐ 4¼" Red/white stranded wire. Pass the wire through the grommet near C-63. Solder the wire to terminal 2 of C-63. The other end will be connected later.

☐ Red solid wire. Connect one end to terminal 1 of C-71. Connect the other end to terminal 2 of C-72.

☐ C-42, 2500 $\mu\mu$f disc capacitor. Cut each lead to ¾". Solder one lead to terminal 1 of C-71 (2 wires). Connect the other lead to terminal 2.

☐ 11" Black/white stranded wire. Pass one end through the grommet near C-71. Solder to terminal 2 of C-71 (2 wires). The other end will be connected later.

☐ Red solid wire. Connect one end to terminal 1 of C-69. Connect the other end to terminal 2 of C-70.

☐ C-54, 2500 $\mu\mu$f disc capacitor. Cut each lead to ½". Solder one lead to terminal 1 of C-69 (2 wires). Connect the other lead to terminal 2.

☐ 12" Red/white stranded wire. Pass one wire through the grommet near C-69. Solder to terminal 2 of C-69 (2 wires). The other end will be connected later.

☐ 9" Red stranded wire and orange solid wire. Pass both wires through the grommet near C-72. Solder the orange wire to terminal 2 of C-72 (2 wires). Solder the red stranded wire to terminal 1 of C-72.

☐ 10½" Yellow stranded wire and yellow solid wire. Pass both wires through the grommet near C-70. Solder the yellow STRANDED wire to terminal 1 of C-70. Solder the yellow SOLID wire to terminal 2 of C-70 (2 wires).

BIAS SHIELD

SEE FIGURE 15 ON SEPARATE SHEET.

☐ Bias shield and ⅜″ grommet. Insert the grommet in the large hole in the shield.

☐ TS-16, 2-terminal strip. Fasten with a 6-32 x ¼″ screw, lockwasher and nut.

☐ TS-17, 2-terminal strip. Fasten with a 6-32 x ¼″ screw, lockwasher and nut.

☐ L-6, peaking coil. Cut each lead to ¾″. Solder one lead in the BACK hole of terminal 1 of TS-16. Solder the other lead in the BACK hole of terminal 2.

☐ L-7, peaking coil. Cut each lead to ¾″. Solder one lead in the BACK hole of terminal 1 of TS-17. Solder the other lead in the BACK hole of terminal 2.

☐ R-87, 82K resistor (gray, red, orange) and a 1¼″ length of black tubing. Place the tubing over a lead (DO NOT SHORTEN THE LEADS.) Connect this lead to terminal 2 of TS-16. The other lead will be connected later.

☐ R-88, 82K resistor (gray, red, orange) and a 1¼″ length of black tubing. Place the tubing over a lead (DO NOT SHORTEN LEADS). Connect this lead to terminal 1 of TS-17. The other lead will be connected later.

☐ 5″ RED shielded cable. Remove 1″ outer insulation and ¼″ innner insulation from both ends of the cable. Remove the shield wire from one end.

☐ At the end of the cable WITHOUT the shield wire, connect the inner conductor to terminal 1 of TS-16. Feed the other end through the grommet.

☐ 7″ Gray shielded cable. Prepare this cable exactly as you did the 5″ red cable.

☐ At the end of the cable WITHOUT the shield wire, connect the inner conductor to terminal 2 of TS-17. Feed the other end through the grommet.

☐ C-65, trimmer capacitor. Mount to TS-17 by inserting the terminals on the capacitor in the terminals of TS-17. Make sure the adjusting screw on the capacitor is not touching the mounting tab of the terminal strip. Solder terminal 1 of TS-17 (2 wires in the front hole). Solder terminal 2 (2 wires in the front hole).

☐ C-66, trimmer capacitor. Similarly mount this capacitor to TS-16. Make sure the adjusting screw on the capacitor is not touching the mounting tab of the terminal strip. Solder terminal 1 of TS-16 (2 wires in the front hole). Solder terminal 2 (2 wires in the front hole).

THIRD WIRING-TOP

SEE FIGURE 16 ON SEPARATE SHEET.

☐ C-21, 10 — 10μf, capacitor in can. Insert the can in its proper mounting holes in the PLAYBACK circuit board. Turn the chassis over and solder the terminals to the foil. Make sure the coils on the terminal strip are not touching the can.

☐ C-5, 10 — 10μf, capacitor in can. Mount this capacitor in the same manner as C-21. Make sure J-13 does not come in contact with the metal can of C-5.

☐ Two #6 x 5/16″ Spade bolts. Mount to the inside of the bracket as shown in detail A. Fasten each one with a 6-32 x ¼″ screw, lockwasher and nut. Make sure the shoulder on the bolt is facing away from the surface of the bracket.

THIRD WIRING-TOP

☐ Bracket. Place the assembled bracket over the top of the chassis so the two spade bolts fit into the holes near the record circuit board. Make sure there are no shielded cables under the edge of the bracket. Fasten with two 6-32 nuts and lockwashers. Fasten the other side of the bracket to the chassis and playback circuit board with three 4-40 x ¼" screws, and nuts. If the bracket does not fit properly check the position of the shoulder on the spade bolts.

☐ Solid yellow wire from terminal 2 of C-70. Solder in hole 23 of the RECORD circuit board.

☐ Red/white wire from terminal 2 of C-69 and yellow wire from terminal 1 of C-70. Twist together for their full length and feed through the large hole at the back of the RECORD circuit board.

☐ Orange wire from terminal 2 of C-72. Solder in hole 20 of the RECORD circuit board.

☐ Black/white wire from terminal 2 of C-71 and red wire from terminal 1 of C-72. Twist together for their full length and feed through the same hole as the other twisted pair.

☐ With the exception of the orange wire from terminal 1 of C-61, feed all remaining wires from the grommets through the rectangular hole in the chassis.

☐ Selector switch S-1. Before installing S-1, bend the following wires up toward the top of the switch. Yellow wire, red wire and top bare wire on wafer C. Yellow wire and top bare wire on wafer B. Yellow wire from terminal 8 on wafer A. Feed all remaining wires through the two holes in the chassis when the switch is mounted.

☐ To mount the selector switch, first remove the ⅜" nut (if it has one). Be sure the red dot is at the top of the switch. Keep the rear of the switch raised above the bracket while inserting the threaded shaft at the front of the switch into its mounting hole in the sub-panel. Make sure the locating tab fits into its slot in the sub-panel as you lower the back of the switch into position. Fasten with a ⅜" nut.

WAFER A.

☐ Solder the yellow wire from terminal 8 to terminal 2 of TS-11 (2 wires).

WAFER B.

☐ Solder the orange wire from terminal 1 of C-61 to terminal 3 of wafer B (2 wires).

☐ Feed the yellow wire from terminal 9 through the grommet shown and solder to terminal 1 of C-63.

WAFER C.

☐ Feed the red wire from terminal 4 through the grommet shown and solder to terminal 1 of C-60.

☐ Feed the yellow wire from terminal 9 through the grommet shown and solder to terminal 1 of C-62.

☐ Back cover assembly. Feed the wires from R-105 (top control) through the top ⅜" grommet on the bracket. Feed the wires from R-104 (bottom control) through the bottom ⅜" grommet. Fasten the back cover to the bracket with two 6-32 x ¼" screws. Make sure the disc capacitors attached to C-69 and C-71 do not short against the back cover.

☐ Blue wire and white wire from top grommet. Twist together. Solder the blue wire in hole 21 of the RECORD circuit board. Solder the white wire in hole 22.

☐ Brown wire and green wire from bottom grommet. Twist together. Solder the brown wire in hole 24 of the RECORD circuit board. Solder the green wire in hole 25.

☐ Green/white wire from bottom grommet. Solder in hole 19 of the RECORD circuit board.

☐ Mount the Bias shield assembly to the chassis. Fasten with two 4-40 x ¼" screws and nuts. Be sure the capacitors and resistors are not touching the metal can on L-5.

☐ Red cable from bias shield. Solder the shield wire in hole 7 of the RECORD circuit board. Solder the inner conductor in hole 8.

☐ Gray cable from bias shield. Solder the shield wire in hole 15 of the RECORD circuit board. Solder the inner conductor in hole 16.

SEE FIGURE 17 ON SEPARATE SHEET.

- ☐ C-26, 1000-1000μf capacitor in aluminum can. Position the two terminals as shown (note position of triangle and half circle). Insert the mounting tabs in the slots of the mounting plate from the top of the chassis. Twist each tab a ¼ turn with your long-nose pliers.
- ☐ C-29, 30-30-30μf capacitor in aluminum can. Position the terminals as shown and mount in the same manner as C-26.
- ☐ AC-1, AC receptacle. Mount with two 6-32 x ⅜" screws, lockwashers and nuts.
- ☐ Orange wire. Solder one end to terminal 1 of C-26. Connect the other end to terminal 1 of TS-3.
- ☐ Yellow wire. Solder one end to terminal 2 of C-26. Connect the other end to terminal 3 of TS-3.
- ☐ Red wire. Connect one end to terminal B of C-26. Connect the other end to terminal B of C-29.
- ☐ Red wire. Solder one end to terminal B of C-26 (2 wires). Connect the other end to terminal 2 of TS-4.
- ☐ Red wire. Solder one end to terminal B of C-29 (2 wires). Connect the other end to terminal 1 of TS-8.
- ☐ Orange wire. Connect one end to terminal 3 of C-29. Connect the other end to terminal 3 of TS-7.
- ☐ Orange wire. Solder one end to terminal 2 of C-29. Connect the other end to terminal 2 of TS-7.
- ☐ White wire. Connect one end to terminal 2 of TS-7. Solder the other end in hole T of the RECORD circuit board.
- ☐ Red wire. Solder one end to terminal 1 of AC-2. Connect the other end to terminal 1 of AC-1.
- ☐ Red wire. Connect one end to terminal 2 of AC-2. Connect the other end to terminal 2 of AC-1.
- ☐ R-51, 2 Ω , 5 watt resistor (square shaped). Connect one lead to terminal 3 of TS-4. Connect the other lead to terminal 1 of TS-3. Keep leads short.
- ☐ R-97, 2 Ω, 5 watt resistor (square shaped). Connect one lead to terminal 1 of TS-3. Connect the other lead to terminal 3 of TS-3. Keep leads short.
- ☐ Violet wire from S-1, Wafer A. Solder to terminal 2 of J-11.
- ☐ Green wire from TS-10. Solder in hole S of the PLAYBACK circuit board.
- ☐ Blue wire from TS-10. Solder in hole R of the PLAYBACK circuit board.
- ☐ Orange wire from S-1 Wafer A. Connect to terminal 3 of TS-9.
- ☐ Yellow wire from C-61. Connect to terminal 4 of L-5.
- ☐ Blue wire from C-60. Connect to terminal 1 of L-5.
- ☐ Green/white stranded wire from S-1 wafer B. Solder to terminal 5 of L-5.
- ☐ Black/white stranded wire from S-1 wafer C. Solder to terminal 2 of L-5.
- ☐ Brown/white stranded wire from C-62. Solder to the long terminal on J-9.
- ☐ Red/white stranded wire from C-63. Solder to the long terminal on J-10.
- ☐ Orange wire. Solder one end in hole C of the PLAYBACK circuit board. Solder the other end in hole K.

To prevent accidental shorts while wiring and soldering the four slide switches, perform the following:

Slip a piece of paper under the switch being wired to catch wire clippings and solder splashes.

Bend the terminals of the switches upward at a slight angle to allow more room for wiring.

Feed the bare ends of the wires up through the bottoms of the holes in the terminals. Make sure the insulation on the wire is snug against the terminal but not in the hole.

Make a neat solder joint and clip the excess wire length. Remove the paper after you have finished wiring the switch.

- ☐ Green wire. Solder one end to terminal 10 of S-2. Solder the other end in hole E of the PLAYBACK circuit board.
- ☐ R-100, 27K resistor (red, violet, orange). Cut each lead to ¾". Solder one lead to terminal 9 of S-2. Connect the other lead to terminal 11.

FIRST WIRING-BOTTOM

☐ Red cable and gray cable from S-1 wafer A (shield wires removed at unconnected ends). Place two 1″ lengths of red tubing over these cables. Make sure both cables go through each length of tubing.

☐ Solder the inner conductor of the RED cable to terminal 7 of S-2.

☐ Solder the inner conductor of the GRAY cable to terminal 1 of S-2. Push one of the lengths of the red tubing over the terminals on the switch.

☐ Two shielded cables from the hole in the PLAYBACK circuit board. Place a 1″ length of red tubing over these cables as shown.

☐ Connect the inner conductor of the RED shielded cable to terminal 8 of S-2.

☐ Connect the inner conductor of the GRAY cable to terminal 2 of S-2.

☐ ¾″ thin bare wire. Connect one end to terminal 7 of S-3. Solder the other end to terminal 6.

☐ Blue wire and 2″ length of red tubing. Solder one end of the wire to terminal 7 of S-3 (2 wires). Place the tubing over the wire. Solder the other end of the wire in hole J of the RECORD circuit board.

☐ Red wire. Solder one end to terminal 4 of S-3. Connect the other end to terminal 5.

☐ Brown wire. Solder one end in hole T of the PLAYBACK circuit board. Connect the other end to terminal 1 of TS-7.

☐ Violet wire. Solder one end in hole D of the PLAYBACK circuit board. Route the wire under the cables, as shown, and connect to terminal 5 of S-3.

NOTE: To prevent pulling the wires out of the two conductor cable, hold the wires with your long-nose pliers while removing the inner insulation.

☐ 15½″ two conductor shielded cable and two ¾″ lengths of yellow tubing. From both ends of the cable, remove 1″ outer insulation and ¼″ inner insulation from each of the wires. Remove the shield wire from one end.

☐ At the end of the cable WITHOUT the shield wire, place a length of tubing over each wire. Solder the black wire to terminal 8 of S-4. Solder the red wire to terminal 9. Slip the tubing over the terminals.

☐ At the other end of the cable, solder the red wire in hole 9 of the PLAYBACK circuit board. Solder the black wire in hole 10. The shield wire will be connected later.

☐ Yellow wire. Solder one end to terminal 11 of S-4. Solder the other end in hole B of the RECORD circuit board.

☐ Two cable clamps. Mount to the record circuit board as shown and fasten with a 6-32 x ⅜″ screw.

☐ Red/white wire from C-69 and yellow wire from C-70 (twisted pair). Feed these wires through the cable clamp indicated. Solder the red/white wire to terminal 10 of S-4. If the wire is too long, trim to proper length. Solder the yellow wire to terminal 12.

☐ Brown wire. Solder one end to terminals 2 and 4 of S-5. Solder the other end to terminal 2 of AC-2 (3 wires).

☐ 1¼″ Thin bare wire and ¾″ black tubing. Place the tubing over the wire. Connect one end of the wire to terminal 3 of L-5. Connect the other end to terminal 6.

☐ C-31, 150 $\mu\mu$f disc capacitor. Cut both leads to ½″. Solder one lead to terminal 4 of L-5 (2 wires). Solder the other lead to terminal 3 (2 wires).

☐ C-32, 150 $\mu\mu$f disc capacitor. Cut both leads to ½″. Solder one lead to terminal 1 of L-5 (2 wires). Connect the other lead to terminal 6.

☐ 1″ Thin bare wire and ½″ black tubing. Place the tubing over the wire. Solder one end of the wire to pin 8, V-9. Connect the other end to pin 3.

☐ White wire and Gray wire. Twist the wires together. At the even end of the pair, solder the gray wire to terminal 2 of TS-2 (2 wires). Solder the white wire to terminal 1 (2 wires).

☐ At the other end of the pair connect the white wire to terminal 5 of V-9. Connect the gray wire to terminal 9.

☐ R-39, 1.2K (brown, red, red). Cut both leads to ½". Solder one lead to terminal 3 of R-41 (terminal closest to chassis). Connect the other lead to pin 7 of V-9.

☐ R-50, 22 Ω (red, red, black) 1 watt. Solder one lead to terminal 4 of TS-8 (2 wires). Connect the other lead to terminal 3.

☐ R-49, 68K (blue, gray, orange) 2 watt. Connect one lead to terminal 4 of TS-7. Connect the other lead to terminal 2 of TS-8.

☐ R-47, 10K (brown, black, orange) 1 watt. Solder one lead to terminal 2 of TS-7 (4 wires). Connect the other lead to terminal 3.

SEE FIGURE 18 ON SEPARATE SHEET.

☐ R-1, 10K resistor (brown, black, orange). Cut each lead to ½". Solder one lead in hole A of the PLAYBACK circuit board. Solder the other lead to the long terminal on J-1.

☐ R-34, 10K resistor (brown, black, orange). Cut each lead to ½". Solder one lead in hole J of the PLAYBACK circuit board. Solder the other lead to the long terminal on J-4.

☐ 7" RED shielded cable and ¾" length of red tubing. From one end of the cable, remove 1" outer insulation and ¼" inner insulation. From the other end of the cable, remove ¾" outer insulation and ¼" inner insulation. Remove the shield wire from the ¾" end of the cable.

☐ Place the length of red tubing over the cable. At the end of the cable WITHOUT the shield wire, solder the inner conductor to terminal 8 of S-2 (2 wires). Solder the other end of the cable to the long terminal on J-2. The shield wire will be connected later.

☐ 7" GRAY shielded cable. Prepare this cable exactly as you did the 7" red cable.

☐ Feed the cable through the red tubing on the 7" red cable so the end WITHOUT the shield wire is toward S-2. Solder the inner conductor to terminal 2 of S-2 (2 wires). At the other end of the cable, solder the inner conductor to the long terminal on J-3. The shield wire will be connected later.

☐ Tubing attached to cables going to S-2. Push this tubing as close to the switch terminals as possible.

☐ Green wire. Solder one end to terminal 4 of S-2. Solder the other end in hole V of the PLAYBACK circuit board.

☐ R-101, 27K resistor (red, violet, orange). Cut each lead to ¾". Solder one lead to terminal 3 of S-2. Connect the other lead to terminal 5.

☐ Violet wire. Connect one end to terminal 1 of S-3. Solder the other end in hole N of the PLAYBACK circuit board.

☐ ¾" Thin bare wire. Solder one end to terminal 2 of S-3. Connect the other end to terminal 3.

SECOND WIRING-BOTTOM

- ☐ Red wire. Connect one end to terminal 1 of S-3. Solder the other end to terminal 8.
- ☐ Yellow wire. Solder one end in hole M of the RECORD circuit board. Feed the other end through the large tubing that contains a blue wire. Solder to terminal 3 of S-3 (2 wires).
- ☐ 16½" two conductor shielded cable and two ¾" lengths of yellow tubing. From both ends of the cable, remove 1" outer insulation and ¼" inner insulation from each of the wires. Remove the shield wire from one end of the cable.
- ☐ At the end of the cable WITHOUT the shield wire, place a length of tubing over each wire. Solder the black wire to terminal 2 of S-4. Solder the red wire to terminal 3. Slip the tubing over the terminals on S-4.
- ☐ At the other end of the cable, solder the red wire in hole 11 of the PLAYBACK circuit board. Solder the black wire in hole 12. The shield wire will be connected later.
- ☐ Twisted pair from hole in record board (red and black/white wires). Feed the pair through the cable clamp. Solder the black/white wire to terminal 4 of S-4. Shorten the wire if necessary. Solder the red wire to terminal 6 of S-4.
- ☐ Yellow wire. Solder one end to terminal 5 of S-4. Solder the other end in hole S of the RECORD circuit board.
- ☐ ½" Thin bare wire. Solder one end to terminal 4 of V-9. Connect the other end to pin 5.
- ☐ White wire and brown wire. Solder one end of the white wire to pin 5 of V-9. (3 wires). Solder one end of the brown wire to pin 9 (2 wires).
- ☐ Twist the white and brown wires together and feed them through the grommet near S-3.
- ☐ Red/white solid wire. Solder one end to terminal 3 of C-29 (2 wires). Solder the other end to terminal 1 of J-11.
- ☐ 6" GRAY shielded cable. Remove ¾" outer insulation and ¼" inner insulation from both ends of the cable. Remove the shield wire from one end.
- ☐ At the end of the cable WITH the shield wire, solder the inner conductor to the long terminal on J-8. The shield wire will be connected later. Feed the free end through the rectangular hole in the chassis.
- ☐ 5½" RED shielded cable. Prepare this cable exactly as you did the 6" gray cable.
- ☐ At the end of the cable WITH the shield wire, solder the inner conductor to the long terminal on J-7. The shield wire will be connected later. Feed the free end of the cable through the rectangular hole in the chassis.
- ☐ Yellow wire. Solder one end in hole U of the RECORD circuit board. Connect the other end to terminal 1 of TS-3.
- ☐ Red wire. Solder one end in hole D of the RECORD circuit board. Connect the other end to terminal 1 of TS-3.
- ☐ Yellow wire. Solder one end to terminal 1 of C-29. Connect the other end to terminal 1 of TS-7.
- ☐ Yellow wire. Connect one end to terminal C of C-26. Solder the other end in hole E of the RECORD circuit board.
- ☐ Blue wire. Solder one end to terminal C of C-26 (2 wires). Solder the other end in hole K of the RECORD circuit board.
- ☐ Red/white solid wire. Solder one end to terminal A of C-26. Solder the other end in hole L of the PLAYBACK circuit board.
- ☐ Red wire. Connect one end to terminal 1 of the fuse holder, F-1. Connect the other end to terminal 1 of AC-1.
- ☐ R-46, 10K (brown, black, orange) 1 watt. Solder one lead to terminal 1 of TS-7 (3 wires). Connect the other lead to terminal 3.
- ☐ R-48, 330 Ω (orange, orange, brown) 2 watt. Solder one lead to terminal 3 of TS-7 (4 wires). Connect the other lead to terminal 2 of TS-8.
- ☐ R-40, 1.2K (brown, red, red) and ¾" length of black tubing. Slip the tubing over one of the leads. Connect this lead to terminal 2 of V-9. Solder the other lead to terminal 1 of R-41.
- ☐ C-24, .02μf disc capacitor. Cut both leads to ½". Solder one lead to terminal 1 of AC-1 (3 wires). Solder the other lead to terminal 2 (2 wires).

SEE FIGURE 19 ON SEPARATE SHEET.

- ☐ ¾″ Thin bare wire. Connect one end to terminal 4 of TS-7. Connect the other end to terminal 1 of TS-8.
- ☐ C-27, 100μf electrolytic capacitor and 1¾″ length of black tubing. Place the tubing over the lead marked plus (+). Connect this lead to terminal 2 of TS-8. Connect the other lead to terminal 1 of TS-1.
- ☐ C-28, 100μf electrolytic capacitor and two 1¾″ lengths of black tubing. Place the tubing over both leads. Solder the lead marked plus (+) to terminal 1 of TS-1 (3 wires). Connect the other lead to terminal 4 of TS-7. Make sure both capacitors fit flush against the surface of the chassis.

NOTE: Wire the diodes to their terminals EXACTLY as shown. Hold the lead being soldered with your long-nose pliers to reduce heat transfer to the diode and prevent possible damage.

- ☐ E-2, Silicon diode. Cut both leads to 1″. Connect one lead to terminal 3 of TS-8. Solder the other lead to terminal 2 of TS-8 (4 wires).
- ☐ E-1, Silicon diode. Cut both leads to 1¼″. Solder one lead to terminal 3 of TS-8 (3 wires). Solder the other lead to terminal 1 of TS-8 (3 wires).
- ☐ E-3, Silicon diode. Cut both leads to 1″. Connect one lead to terminal 1 of TS-4. Connect the other lead to terminal 2.
- ☐ E-6, Silicon diode. Cut both leads to 1¼″. Solder one lead to terminal 1 of TS-4 (3 wires). Connect the other lead to terminal 3.
- ☐ E-5, Silicon diode. Cut both leads to 1¼″. Solder one lead to terminal 3 of TS-4 (3 wires). Connect the other lead to terminal 4.
- ☐ E-4, Silicon diode. Cut both leads to 1″. Solder one lead to terminal 4 of TS-4 (3 wires). Solder the other lead to terminal 2 (3 wires).
- ☐ 12″ Red/white solid wire. Connect one end to terminal 3 of TS-3. Solder the other end in hole P of the PLAYBACK circuit board.
- ☐ 13″ Orange/white solid wire. Solder one end to terminal 3 of TS-3 (4 wires). Solder the other end in hole G of the PLAYBACK circuit board.
- ☐ R-37, 4.7 meg (yellow, violet, green). Cut one of the leads to ½″. Solder this lead to terminal 5 of S-3 (3 wires). The other lead will be connected later.
- ☐ R-38, 4.7 meg (yellow, violet, green). Cut one of the leads to ½″. Solder this lead to terminal 1 of S-3 (3 wires). The other lead will be connected later.
- ☐ C-33, .0022μf tubular capacitor and two ½″ lengths of black tubing. Place the tubing over both leads. Solder one lead to terminal 6 of V-9 (2 wires). Connect the other lead to terminal 2.
- ☐ C-35, .01μf tubular capacitor and two ½″ lengths of black tubing. Solder one lead to terminal 2 of V-9 (3 wires). Connect the other lead to terminal 7.
- ☐ C-34, .0022μf tubular capacitor and two ½″ lengths of black tubing. Solder one lead to terminal 7 of V-9 (3 wires). Solder the other lead to terminal 1 (2 wires).
- ☐ 6″ Heavy bare wire. Place a ¾″, 90° bend in each end of the wire. Feed the wire through the ⅜″ grommet attached to the shield.
- ☐ Solder one end of the wire to the pair of short terminals on J-7 and J-8. Solder the other end to the short terminal on J-1. Make sure the wire does not touch the long terminals on the pin jacks.
- ☐ 1″ Thin bare wire. Make a good mechanical connection to the heavy bare wire just above hole U of the PLAYBACK circuit board. Solder this connection. Solder the other end in hole U.
- ☐ 1″ Thin bare wire. In a similar manner, solder one end to the heavy bare wire just above hole B. Solder the other end in hole B.
- ☐ 1″ Thin bare wire. Make good mechanical connections. Solder one end to the short terminal on J-4. Solder the other end to the heavy bare wire.
- ☐ Red wire. Solder one end to the short terminal on J-2. Connect the other end to the short terminal on J-3.
- ☐ Orange wire. Solder one end to the short terminal on J-3 (2 wires). Solder the other end to the short terminals on J-5 and J-6. Make sure the wire does not touch the long terminals on the jacks.
- ☐ C-73, .01μf disc capacitor. Solder one lead to terminal 1 of TS-3 (6 wires). Connect the other lead to terminal 2.
- ☐ Blue wire. Solder one end to terminal 2 of TS-3 (2 wires). Solder the other end to terminal 3 of J-11.

THIRD WIRING-BOTTOM

Solder the following wires to the heavy bare wire at the points shown in Figure 19.

☐ Shield wire from the two conductor cable terminating in holes 9 and 10 of the PLAYBACK circuit board.

☐ Shield wire from the Red cable attached to J-2.

☐ Shield wire from the GRAY cable attached to J-3.

☐ Shield wire from the RED cable attached to J-7.

☐ Shield wire from the GRAY cable attached to J-8.

☐ Shield wire from the two conductor cable terminating in holes 11 and 12 of the PLAYBACK circuit board.

☐ 11½" RED shielded cable and a ¾" length of red tubing. From one end of the cable, remove ¾" outer insulation and ¼" inner insulation. Remove the shield wire at this end. From the other end of the cable, remove ½" outer insulation and ¼" inner insulation.

☐ At the end of the cable WITHOUT the shield wire, solder the inner conductor to terminal 12 of S-2. Place the tubing over the cable. Route as shown.

☐ At the other end of the cable, solder the inner conductor in hole Q of the RECORD circuit board. Solder the shield wire in hole P.

☐ 12" GRAY shielded cable. Prepare exactly as you did the 11½" RED cable.

☐ At the end of the cable WITH the shield wire, solder the inner conductor in hole F of the RECORD circuit board. Solder the shield wire in hole G.

☐ Route the cable as shown. Solder the inner conductor to terminal 6 of S-2. Slip the tubing over the terminals.

☐ A. C. line cord and bushing. See Figure 20. Fasten the bushing to the line cord 8½" back from the stripped end. If you have difficulty in mounting the bushing to the chassis, compress the top and bottom of the bushing with your long-nose pliers and slip into position.

☐ Separate the wires at the stripped end of the power cord by pulling them apart for the full 8½". Cut a 3" length from one of the wires and discard it. Strip away ¼" insulation from the shorter wire and tin the end with solder. Route this wire as shown and solder to terminal 1 of fuse holder, F-1 (2 wires). Solder the other wire of the power cord to terminals 1 and 3 of S-5. Make sure the bare end does not touch the chassis.

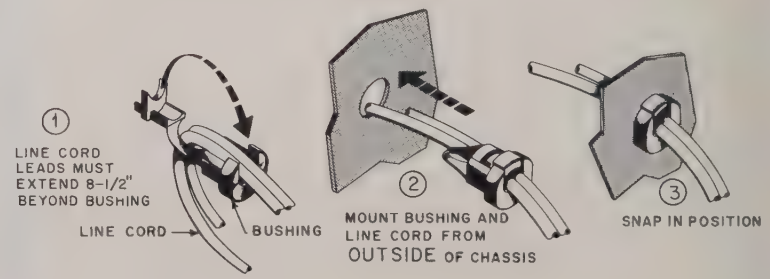


FIGURE 20.

SEE FIGURE 21 ON SEPARATE SHEET.

☐ 15¼″ Heavy bare wire. Straighten the wire by removing the kinks and bends with your long-nose pliers. Feed the wire through the terminals on TS-5 and TS-6. Place a 90° bend ¾″ long in the end of the wire near TS-6. Solder this end to terminal 4 of TS-7 (4 wires).

☐ Place another 90° bend in the wire at TS-5 so the end of the wire lays directly across the heavy bare wire previously connected. Make a good mechanical connection near J-6 and solder. Be sure this wire does not touch any of the terminals on S-3 and S-4.

☐ Solder the wire in the terminals of TS-5 and TS-6.

☐ R-103, 470 Ω resistor (yellow, violet, brown). Cut each lead to ¾″. Solder one lead to terminal 3 of V-9 (2 wires). Solder the other lead to the heavy bare wire at the point shown.

☐ Red wire. Solder one end to terminal 6 of L-5 (3 wires). Solder the other end to the heavy bare wire.

Solder the following wires to the heavy bare wires:

☐ Bare wire from wafer B of S-1.

☐ Bare wire from wafer C of S-1.

☐ Shield wire on RED cable from wafer A of S-1 (other end of cable attached to S-2).

☐ Shield wire on GRAY cable from wafer A of S-1 (other end of cable attached to S-2).

☐ Yellow wire from wafer A of S-1.

☐ R-37 from terminal 5 of S-3.

☐ R-38 from terminal 1 of S-3.

☐ 1¼″ Thin bare wire. Make a good mechanical connection to the heavy bare wire just over hole L of the RECORD circuit board. Solder this connection. Solder the other end of the wire in hole L.

☐ R-36, 1 meg resistor (brown, black, green). Cut each lead to ½″. Solder one lead in hole Z of the PLAYBACK circuit board. Insert the other lead in hole M.

☐ Gray shielded cable from wafer A of S-1. Solder the inner conductor in hole M of the PLAYBACK circuit (2 wires). Solder the shield wire in hole X.

☐ R-35, 1 meg resistor (brown, black, green). Cut each lead to ½″. Solder one lead in hole Y of the PLAYBACK circuit board. Insert the other lead in hole F.

☐ RED shielded cable from wafer A of S-1. Solder the inner conductor in hole F of the PLAYBACK circuit board (2 wires). Solder the shield wire in hole W.

☐ 17½″ RED shielded cable. From one end of the cable, remove 1¼″ outer insulation and ¼″ inner insulation. From the other end of the cable, remove ½″ outer insulation and ¼″ inner insulation.

☐ At the ½″ end of the cable, solder the inner conductor to the long terminal on J-5. Solder the shield wire to the heavy bare wire. Feed the other end of the cable through the slot in the shield and then through the hole in the RECORD circuit board.

☐ 16½″ GRAY shielded cable. Prepare exactly as you did the 17½″ RED cable.

☐ At the ½″ end of the cable, solder the inner conductor to the long terminal on J-6. Solder the shield wire to the heavy bare wire. Feed the other end of the cable through the slot in the shield and then through the hole in the RECORD circuit board.

☐ Red wire. Solder one end to terminal 2 of R-41. Solder the other end to the short terminals on J-9 and J-10.

☐ Attach the two cable ties to the shielded cables at the points indicated. See Figure 22 for instructions.

☐ 13″ RED shielded cable. From one end of the cable, remove ¾″ outer insulation and ¼″ inner insulation. Remove the shield wire from this end. From the other end of the cable, remove 1″ outer insulation and ¼″ inner insulation.

☐ At the end of the cable WITHOUT the shield wire, solder the inner conductor in hole H of the PLAYBACK circuit board. Route the cable as shown and feed the free end through the square hole in the chassis. Tie a small knot in the end of the cable for identification.

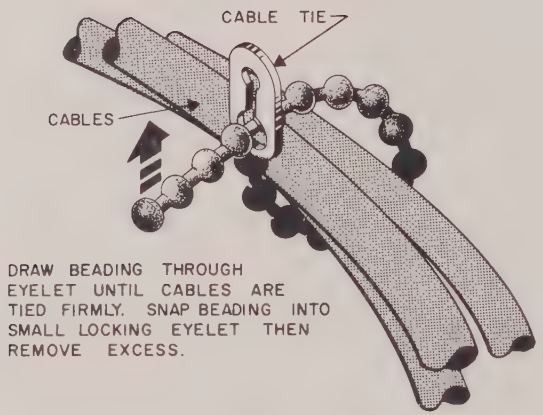

CABLE TIE
CABLES
DRAW BEADING THROUGH EYELET UNTIL CABLES ARE TIED FIRMLY. SNAP BEADING INTO SMALL LOCKING EYELET THEN REMOVE EXCESS.

FIGURE 22.

☐ 11″ GRAY shielded cable. Prepare this cable exactly as you did the 13″ red cable.

☐ At the end of the cable WITHOUT the shield wire, solder the inner conductor in hole Q of the PLAYBACK circuit board. Route the cable as shown and feed the free end through the square hole in the chassis. Tie a small knot in the end of the cable for identification.

☐ 12½″ RED shielded cable. Prepare this cable exactly as you did the 13″ red cable.

☐ At the end of the cable WITHOUT the shield wire, solder the inner conductor to terminal 11 of S-2 (2 wires). Place a 1″ length of red tubing over the cable. Feed the free end of the cable through the square hole in the chassis.

☐ 12½″ GRAY cable. Prepare this cable exactly as you did the 13″ red cable.

☐ Slip the end of the cable WITHOUT the shield wire through the tubing on the red cable. Solder the inner conductor to terminal 5 of S-2 (2 wires). Feed the free end of the cable through the square hole in the chassis. Slip the tubing close to the terminals on S-2.

☐ R-102, 100 Ω resistor (brown, black, brown). Cut each lead to ¾″. Solder one lead to terminal 3 of TS-9 (2 wires). Connect the other lead to terminal 2.

☐ C-64, 20μf electrolytic capacitor, and 2″ length of black tubing. Place the tubing over the positive (+) lead. Solder this lead to terminal 2 of TS-9 (2 wires). Solder the negative (—) lead to terminal 1. Move the twisted pair from V-9 away from the record board so the capacitor fits flush against the chassis.

SEE FIGURE 23.

To protect the RECORD LEVEL meters and the front of the control panel from scratches it is desirable to perform the following operations on a soft flat surface.

☐ Left record level meter and retaining clip. Mount the meter from the outside of the control panel (trim panel) by inserting it in the recessed hole indicated. Place the retaining clip over the back of the meter and fasten with the two screws and washers supplied with the meter.

CAUTION: DO NOT OVERTIGHTEN SCREWS BECAUSE YOU MIGHT DAMAGE THE METER HOUSINGS.

☐ Carefully remove the shunt wire that connects the meter terminals with your long-nose pliers.

☐ Similarly mount the right record level meter in the remaining recessed hole.

☐ Remove the shunt wire that connects the two meter terminals.

☐ Recording decal. Carefully remove the plastic backing from the red transparent decal, as shown. Attach the gummed side of the decal to the inside of the control panel by centering the decal over the rectangular hole at the top of the panel and pressing in place.

CAUTION: When soldering wires to the meter terminals, apply heat sparingly. Too much heat could damage the meter movements.

☐ 4½″ Red/white stranded wire. Solder one end to terminal 1.

☐ 3½″ Black/white stranded wire. Solder one end to terminal 2.

☐ 2½" Green/white stranded wire. Solder one end to terminal 3.

☐ 3½" Black/white stranded wire. Solder one end to terminal 4. The free ends of these four wires will be connected later.

☐ Four flat fiber washers. Place a flat fiber washer over the front of the four phone jacks attached to the sub-panel.

☐ Paper template (rectangular shaped). Place the white paper template over the push button of switch S-3 (3 position slide switch).

☐ Mount the assembled control panel to the front of the sub-panel. Fasten with four ⅜" nuts (one for each of the controls).

☐ P-1 and red wire. SEE FIGURE 24. Solder one end of the red wire in pin 1 of plug P-1. Solder the other end in pin 2.

☐ Insert P-1 into the 3-terminal jack, J-11.

SEE FIGURE 25 ON SEPARATE SHEET.

☐ Twisted pair from grommet near TS-10. Connect the brown wire to the pilot socket with the solder lug attached. Connect the white wire to the solder lug.

☐ C-25, .01μf disc capacitor. Cut both leads to ¾". Solder one lead to the pilot socket with the solder lug attached (3 wires). Solder the other lead to the solder lug (2 wires).

☐ Right Channel Meter. Solder the red/white stranded wire to terminal 1 of TS-10 (2 wires). Connect the black/white stranded wire to terminal 3.

☐ Left Channel Meter. Solder the green/white stranded wire to terminal 4 of TS-10 (2 wires). Solder the black/white stranded wire to terminal 3 (2 wires).

☐ Red shielded cable from J-5. Solder the shield wire to terminal 1 of R-91 (2 wires). Solder the inner conductor to terminal 3.

☐ GRAY shielded cable from J-6. Solder the shield wire to terminal 4 of R-91 (2 wires). Solder the inner conductor to terminal 6.

☐ Playback input shield. Mount to the chassis as shown. Fasten with two #4 x ¼" self-tapping screws.

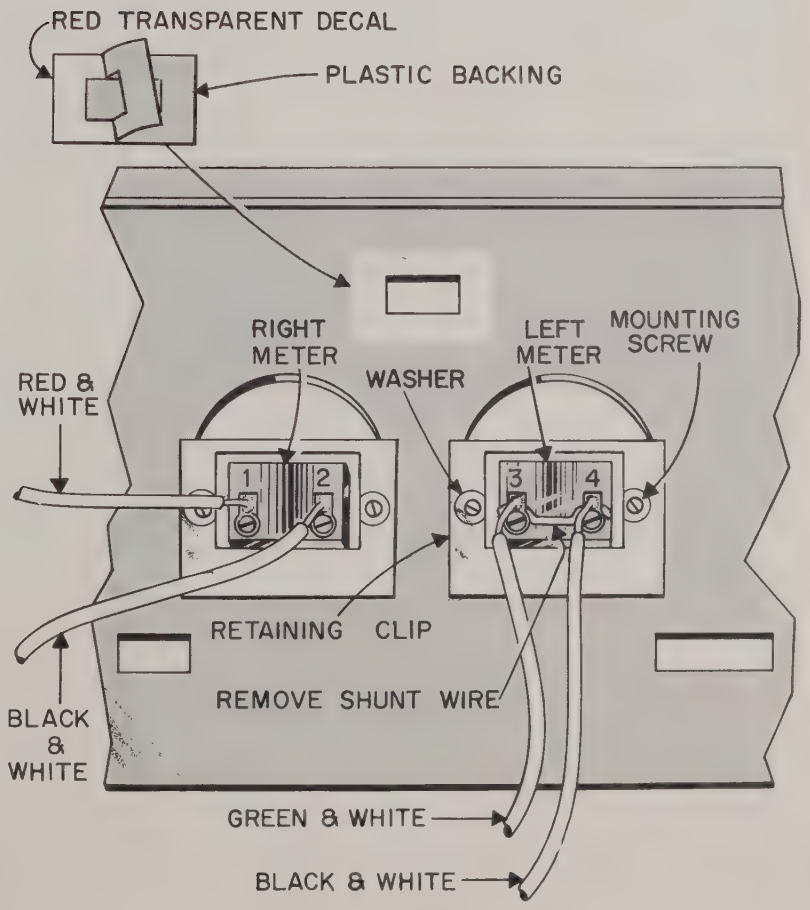


FIGURE 23.

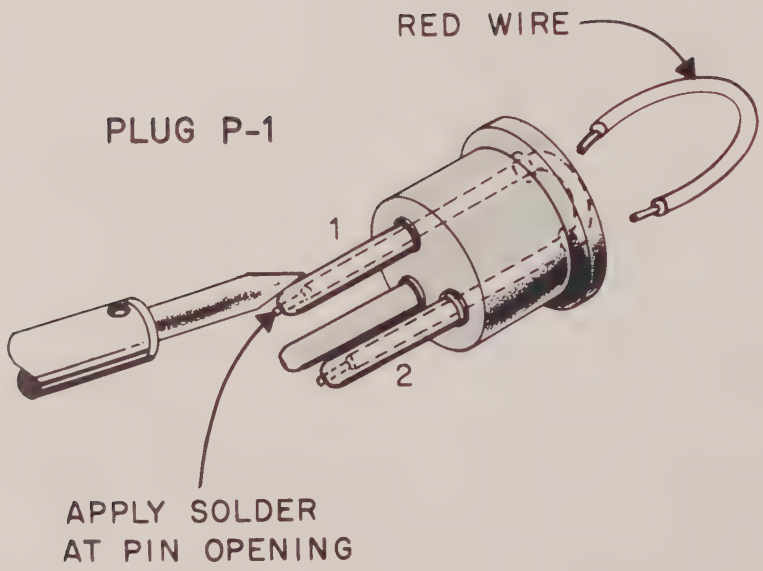


FIGURE 24.

☐ L-3 peaking coil. Insert the two terminals in the RECORD circuit board. Turn the chassis over and solder both terminals to the foil. Be sure the coil is in straight.

☐ L-4, peaking coil. Similarly mount and solder this coil in the RECORD circuit board.

☐ C-47, and C-48 .15μf stand up capacitors. Mount and solder in the RECORD circuit board.

☐ Equalization shield and two 4-40 spade bolts. Fasten the spade bolts to the shield with two 4-40 x ¼" screws, lockwashers and nuts. See Detail B. Do not remove the strip of insulating tape.

☐ Mount the equalization shield to the RECORD circuit board as shown. Be sure no wires are under the shield. Fasten with two 4-40 nuts. The tape is used to insulate L-4 from the shield.

☐ C-36 and C-59, 10-10μf capacitors in aluminum cans. Mount to the RECORD circuit board so the large mounting tabs fit into the large holes. Be sure no wires are under the capacitors. Solder all connections to the foil.

WIRING TS-13

SEE FIGURE 26.

It is important to connect the four resistors to TS-13, the 5-terminal strip, EXACTLY as shown.

☐ R-45, 1K (brown, black, red, gold). Cut both leads to ½". Connect one lead to terminal 4 of TS-13. Connect the other lead to terminal 3.

☐ R-44, 1K (brown, black, red, gold). Cut both leads to ¾". Connect one lead to terminal 5 of TS-13. Solder the other lead to terminal 3 (2 wires).

☐ R-95, 1 meg (brown, black, green, gold) and two ½" lengths of black tubing. Place the tubing over each lead. Connect one lead to terminal 2 of TS-13. Connect the other lead to terminal 5.

☐ R-96, 1 meg (brown, black, green, gold) and two ½" lengths of black tubing. Place the tubing over each lead. Connect one lead to terminal 1 of TS-13. Connect the other lead to terminal 4.

☐ Blue wire. Solder one end to terminal 5 (3 wires). The free end will be connected later.

☐ Green wire. Solder one end to terminal 4 (3 wires). The free end will be connected later.

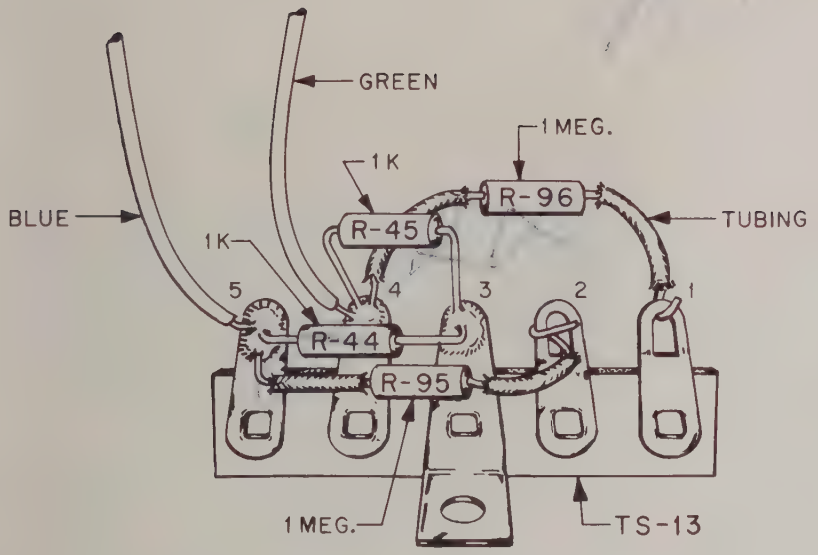


FIGURE 26.

SEE FIGURE 25.

- ☐ S-6, 6 terminal switch and solder lug. Mount this switch to the inside of the bracket with two 6-32 x ¼" screws, lockwashers and nuts. Place the solder lug under the nut shown.
- ☐ TS-13. Mount the partially wired terminal strip to the inside of the bracket with a 6-32 x ¼" screw, lockwasher and nut.
- ☐ Solder the free end of the blue wire from TS-13 to terminal 3 of S-6.
- ☐ Solder the free end of the green wire from TS-13 to terminal 6 of S-6.
- ☐ ½" length of black tubing. Place the tubing over the bare wire on terminal 2, wafer B of S-1. Connect the free end of this wire to terminal 2 of TS-13.
- ☐ 1¼" length of black tubing. Place the tubing over the bare wire on terminal 2, wafer C of S-1. Connect the free end of this wire to terminal 1 of TS-13.
- ☐ R-87, from terminal 1 of TS-16 and 1¼" length of black tubing. Place the tubing over the unconnected lead. Connect the lead to terminal 1 of TS-13.
- ☐ RED shielded cable from J-7. Solder the inner conductor to terminal 1 of TS-13 (4 wires).
- ☐ R-88 from terminal 2 of TS-16 and 1¼" length of black tubing. Place the tubing over the unconnected lead. Connect the lead to terminal 2 of TS-13.
- ☐ GRAY shielded cable from J-8. Solder the inner conductor to terminal 2 of TS-13 (4 wires).
- ☐ Red shielded cable (with knot) from Hole H of the PLAYBACK circuit board. Remove knot. Solder the inner conductor to terminal 5 of S-6. The shield wire will be connected later.
- ☐ Red shielded cable from terminal 11 of S-2. Solder the inner conductor to terminal 4 of S-6. The shield wire will be connected later.
- ☐ Gray shielded cable (with knot) from hole Q of the PLAYBACK circuit board. Remove knot. Solder the inner conductor to terminal 2 of S-6. The shield wire will be connected later.
- ☐ Gray shielded cable from terminal 5 of S-2. Solder the inner conductor to terminal 1 of S-6. The shield wire will be connected later.
- ☐ Shield wires from cables. Solder all shield wires from the cables attached to S-6 to the solder lug (4 wires).
- ☐ Cable Clamp. Place the plastic cable clamp around the four cables and fasten to the bracket with a 6-32 x ¼" screw, lockwasher and nut as shown.

SEE FIGURE 27.

- ☐ Two #47 pilot lamps. Insert a lamp in each of the pilot sockets and twist the bulb slightly to lock in place.
- ☐ Inspect the tap of every tube socket for excessive solder. The solder can be removed by reheating the tube pin.
- ☐ Install the 9 tubes in the positions shown.
- ☐ From the tube shields supplied, select the one that is tapered. Place this shield over V-9 (12BH7) so it snaps around the shield saddle.
- ☐ Install the remaining 8 tube shields on the tubes. Make sure the shield clip on each tube socket presses firmly against the outside of the shield after it has been installed.
- ☐ Install the ½ ampere slo-blo fuse in fuse holder F-1.
- ☐ **Record lamp shield. Form the paper record lamp shield and insert in the rectangular hole above TS-11 as shown in detail A of Figure 25. Route the green wire from the two pilot lamp sockets over the top of the shield to help hold it in place.**

- [ ] Turn the dual concentric shafts on the 3 controls completely counterclockwise.
- [ ] Place a large knob with a hole in the middle over each of these 3 shafts so the red dot is at the lower left.
- [ ] Place a small knob over each of the control shafts that have a large knob. The red dots on the small knobs should be in line with the red dots on the large knobs.
- [ ] Place the remaining large knob over the selector switch.
- [ ] Rotate controls R-104 and R-105 fully counterclockwise (located on back cover). Place a small tapered knob over each of the shafts with the knob markers toward the bottom.

Many of the kits returned to us for repairs are the result of hasty wiring. CAREFULLY CHECK EVERY CONNECTION FOR—NO SOLDER, TOO LITTLE SOLDER OR TOO MUCH SOLDER. If a solder connection appears to be doubtful, reheat the connection. The few minutes spent here on a final check could save you hours of trouble shooting later.

If you have an ohmmeter, measure the resistance of the unit at the points indicated in the resistance chart, at the back of the manual. Your readings should be reasonably close to the values shown on the chart.

- [ ] Plug the power cord into a 110 volt AC socket. Turn the POWER switch to the ON position and observe that the two pilot lamps and tube filaments are lit. If they are not, refer to the TROUBLE HINTS section.

BIAS TRAP ADJUSTMENT

SEE FIGURE 27.

CONTROL SETTINGS

Selector switch in RECORD ST.

Monitor switch in SOURCE.

All level controls to zero (fully counterclockwise).

Bias switch (back of chassis) to NORMAL.

Mult-normal-echo switch to NORMAL.

Equalization switch setting unimportant.

With a screwdriver, turn the adjusting screws on the four bias and erase trimmer capacitors all the way in (fully clockwise). These trimmers are at the back of the chassis.

Turn REC-CURRENT controls R-104 and R-105 fully counterclockwise.

With a screwdriver, adjust C-66 (left channel bias trap), for a minimum reading on the left record meter. Notice, as you adjust C-66, the meter pointer swings downscale, reaches some minimum value and then starts to swing upscale. Stop adjusting C-66 when you reach the point just before the meter pointer starts upscale. The trap is now tuned for maximum rejection of the bias oscillator frequency in the left record channel.

Similarly adjust C-65 (right channel bias trap) for a minimum reading on the right record meter. This gives maximum rejection of the bias oscillator frequency in the right channel record amplifier.

- [ ] Turn the unit off and mount the top cover with six #4 x ¼" self tapping screws.
- [ ] Mount the bottom plate with four #4 x ¼" self tapping screws. Make sure the bottom plate does not pinch any of the wires or cables or touch any of the components.
- [ ] Mount the four plastic feet to the bottom plate with four #6 x ¼" self tapping screws. The heads of the mounting screws should be hidden in the recesses of the feet.

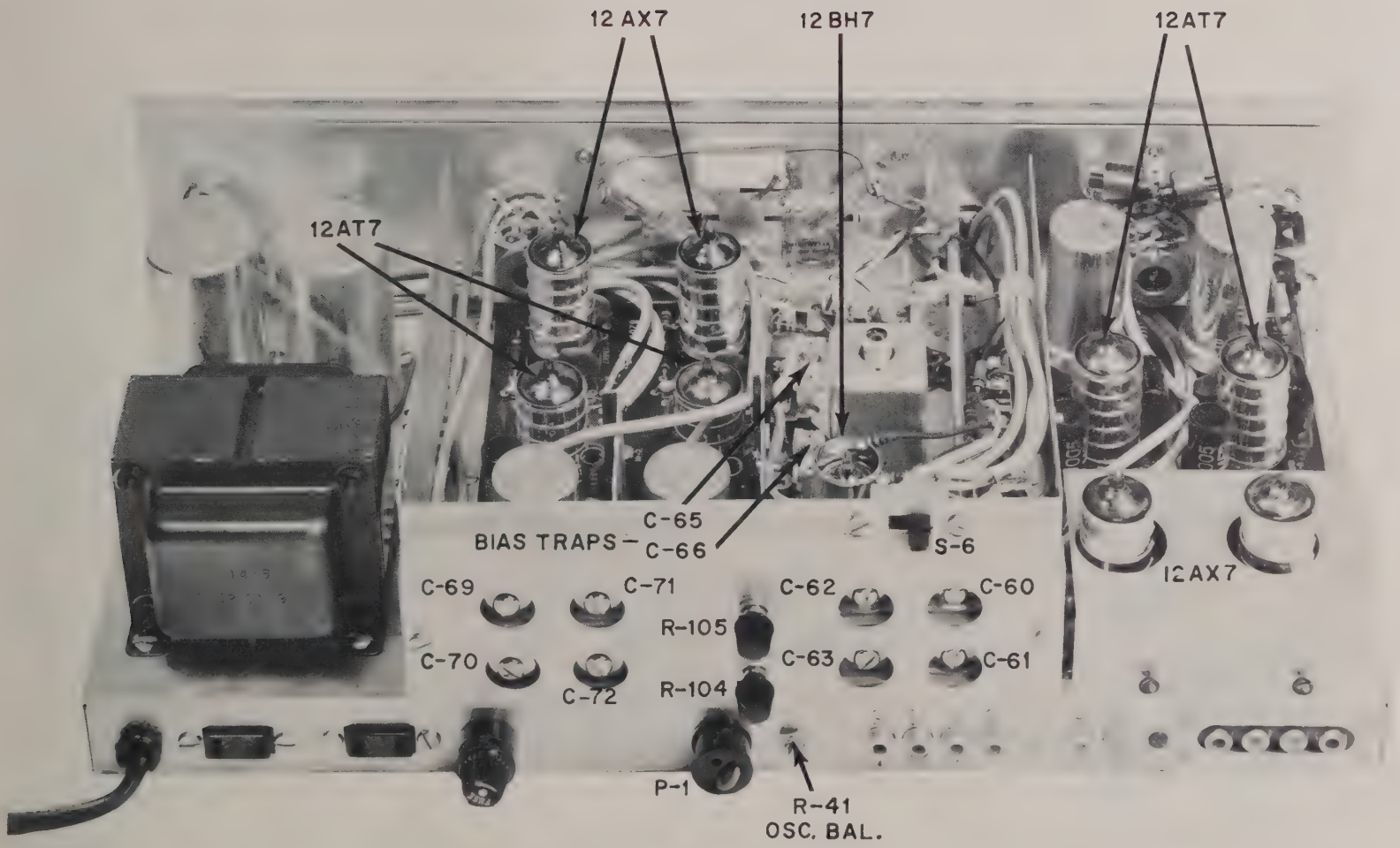
NOTE: To install the optional metal cover, remove the four #6 self tapping screws that hold the feet to the bottom plate. Slide the tape electronics into the cover. Line up the four mounting holes in the tape electronics and cover and mount the four feet as described above.

ALTERNATE WIRING FOR HEADPHONES, RECORD METERS AND MICROPHONES

HEADPHONES

If a separate phone plug is used for each earpiece of your stereo head set, OMIT the red wire that connects terminal 1 of J-13 and terminal 3 of J-12. The red wire is to be installed only if your stereo headset is terminated in a single phone plug.

FIGURE 27.


12 AX7
12 BH7
12AT7
12AT7
C-65
BIAS TRAPS — C-66
S-6
12AX7
C-69
C-71
C-62
C-60
R-105
C-70
C-72
R-104
C-63
C-61
P-1
R-41
OSC. BAL.

METERS

If you wish to have the record level meters indicate the signal strength from the RECORD amplifier only, perform the following:

Remove the two green wires that connect holes V and E of the PLAY-BACK circuit board to terminals 4 and 10 of S-2.

Move the GRAY shielded cable on terminal 5 of S-2 to terminal 6.

Move the RED shielded cable on terminal 11 of S-2 to terminal 12.

MICROPHONES

When using microphones with high outputs such as low cost crystal microphones, you should reduce the gain of the MIC input preamplifiers by paralleling a 100K resistor with R-56 (left channel record circuit board) anl R-83 (right channel record circuit board). This prevents overloading the input stages which could cause distortion.

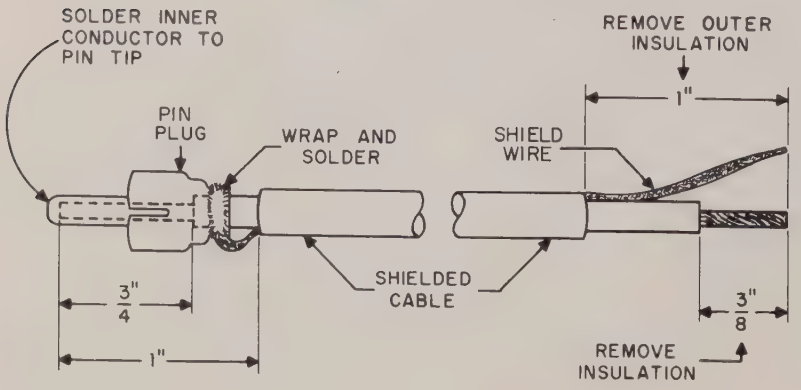


FIGURE 28.

SEE FIGURES 28 AND 29.

NOTE: Cable lengths from two to three feet may be used without affecting performance. If the distance between the transport and preamp is to be greater than three feet, special low capacity cables should be used.

- ☐ Cut six cables 24" in length, prepare as shown in Figure 29. Solder a pin plug to each end of all six cables.
- ☐ Connect the cables between the preamp and transport, as shown in Figure 29. (The two extra cables supplied with the KN 4000 transport can be used to connect the outputs of the tape preamp to your power amplifier.)
- ☐ Solder one end of a wire to the solder lug near J-5 of the preamp. Connect or solder the other end to a convenient point on the transport chassis.
- ☐ Red/white solid wire and remaining pin plug. Solder one end of the wire in the pin of the pin plug. Leave the other end of the wire free. Set the wire aside. It will be used later.

NOTE: To use the tape preamp with a transport having two heads, such as the KN 4200, a special adapter switch must be used. See ACCESSORIES YOU MAY WANT in the back of the manual.

- ☐ Connect the line cord of the tape transport to a 110 volt AC wall outlet.
- ☐ Connect the line cord of the tape preamp to the convenience AC outlet on the transport. If your transport is not equipped with one, use a wall outlet.
- ☐ Place a reel of clean tape on the left spindle of the tape transport (supply reel).
- ☐ Place an empty reel the same size as the supply reel on the right spindle of the transport (take up reel).
- ☐ Thread the tape from the supply reel past the heads and onto the take up reel.
- ☐ Connect a pair of high impedance stereo headphones (crystal) to the MONITOR jacks. (Left phone plug in L jack; right phone plug in R jack).

NOTE: IF YOUR SET OF STEREO PHONES ARE TERMINATED IN A SINGLE PHONE PLUG, INSERT IT IN THE L MONITOR JACK.

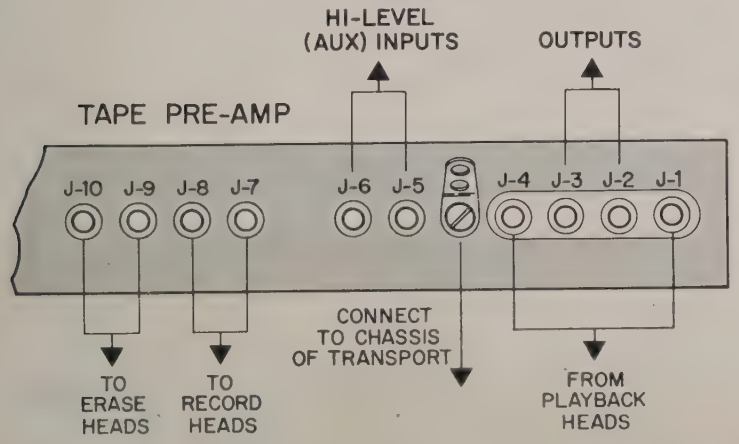
If you wish to use loudspeakers instead of headphones, connect the PLAYBACK OUTPUT jacks (J-2 and J-3) to any high level input on your stereo sound system.

wired for low Impedance Record Head

TRANSPORT SPECIFICATIONS CHART

TRANSPORT	NO. OF HEADS	IMPEDANCE OF RECORD HEAD	REC CURRENT	BIAS AMPS	BIAS VOLTS	ERASE CURRENT	IMPEDANCE OF ERASE HEAD
KN 4000	3	~~High~~	~~.025MA~~	.5	20	12-15MA	Med
KN 4200	2	High	.025MA	.25-.4	44	12-15MA	Med
Viking 85R	2	High	.04MA	.55	——	7.5MA	**High
Viking 85RQ	3	High	.03MA	.3	——	7.5MA	**High
Viking 85ES	2	High	.04MA	.55	——	7.5MA	**High
Viking 85ESQ	3	High	.04MA	.55	——	7.5MA	**High
Viking 85RMQ	3	High	.03MA	.3	20	4MA	**High
KN4200	3	*Med	.07	.5-.7	7	12-15MA	Med
Sony 262D	2	High	.05	——	44	500MA	Low

*For med impedance record heads move blue wire from terminal 1 of L-5 to terminal 2. Move yellow wire from terminal 4 of L-5 to terminal 5.
**For high impedance erase heads move black/white wire from terminal 2 of L-5 to terminal 1. Move green/white wire from terminal 5 of L-5 to terminal 4.
The preamp is wired for high impedance record heads and medium impedance erase heads.



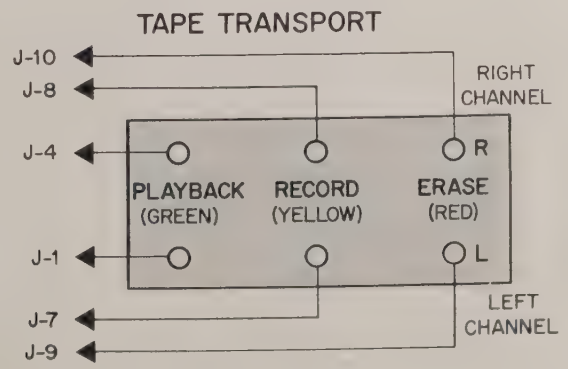


FIGURE 29.

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Note:

SEE FIGURE 27 AND TRANSPORT SPECIFICATION CHART
RECORD CURRENT

Adjust the RECORD CURRENT controls (R-104 and R-105) until the pointer on the knobs indicate the value of record current specified by the manufacturer of your transport. The illustration at the right gives the value of record current for each calibration mark on the back cover of the preamp.

RECORD BIAS (TWO & THREE HEAD TRANSPORTS)

If you have one of the transports listed in the chart perform the following:

CONTROL SETTINGS

Selector switch to RECORD ST.
Bias switch to READ BIAS.
Adapter switch on transport to RECORD (two head transports only).
Connect the transport to the preamp with the shielded cables.

Turn the AC power on.
Adjust C-60 (BIAS-L) until the left meter reads the bias voltage listed for your transport.

Adjust C-61 (BIAS-R) until the right meter reads the same value.

If your transport is not listed in the chart, proper record bias can be obtained by following the instructions for RECORD BIAS (three head transports) or RECORD BIAS (two head transports). FOLLOW the set of instructions that applies to your transport.

RECORD BIAS (three head transports)
CONTROL SETTINGS

Monitor switch to TAPE.
Selector switch to RECORD L.
Bias switch to NORMAL.
Connect the transport to the preamp with the shielded cables.
Connect the pin plug with red/white wire to J-5 (left input).
Insert the bare end of the wire in terminal 3 of P-1.
Back off on the adjusting screw of C-60 (L-BIAS) for seven full turns.
Advance the L PLAYBACK level control about ½ turn.
Advance the L AUX level control about ¾ turn.
Turn the AC power on and start the transport.

A 120 cycle tone should be heard in your headphone or loudspeaker.
Adjust the L AUX level control for a comfortable listening level.
Adjust C-60 (inward) for a peak reading on the left meter (maximum upscale deflection). DO NOT CHANGE THE SETTINGS OF THE LEVEL CONTROLS WHEN MAKING THIS ADJUSTMENT. When the meter is peaked, reverse the direction of your adjustment until the meter reads 1DB below the peak value. You now have the proper record bias voltage for the left channel.

Stop the transport and rewind to the beginning.

Set the bias switch to READ BIAS and note the reading on the meter.
Set the selector switch to RECORD ST and adjust C-61 (BIAS-R) until the right meter reads the same value as the left. Both channels now have the proper record bias voltage.

No reading on the meters (with the bias switch in READ BIAS) indicates that the proper bias voltage for your record head is too low for the meters to read. Repeat the above procedure to adjust the right channel bias voltage using the right channel controls and jacks.

Set the selector switch to RECORD R.
Set the bias switch to NORMAL.
Reduce the left playback and aux level controls to zero.
Advance the right playback and aux level controls half way.
Move the pin plug from J-5 to J-6 (right input).
All other control settings remain unchanged.

Start the transport and adjust C-61 (BIAS-R) for the 1DB down point on the right meter.

RECORD BIAS (two head transports).
CONTROLS SETTINGS

Selector switch to RECORD L.
Bias switch to NORMAL.
Monitor switch to TAPE.
Set the two head adapter switch to RECORD (Located on transport chassis unless you are using the Knight adapter switch 83Y940).
Insert the pin plug with red/white wire in J-5 (left input).
Insert the bare end of the red/white wire in terminal 3 of P-1.
Advance the left aux level control about half way.
Back off on the adjusting screw of C-60 (L-BIAS) for seven full turns.
Start the transport and record 30 seconds of the 120 cycle tone.
Stop the transport.

Turn To page 34

PLAYBACK

Set the selector switch to PLAY L.
Rewind the tape to the beginning.
Set the two head adapter switch to PLAY.
Start the transport and advance the left playback level control for a comfortable listening level in your headphones or speaker. The left meter should be indicating some value. NOTE THE READING ON THE METER. DO NOT CHANGE THE SETTINGS ON THE AUX AND PLAYBACK LEVEL CONTROLS.
Give the adjusting screw on C-60 (L-BIAS) ⅛ of a turn inward.
Stop the transport and rewind the tape to the beginning.
Set the selector switch in RECORD L.
Set the two head adapter switch to RECORD.

Start the transport and record 30 seconds of the tone.
Stop the transport and repeat the playback procedure. Without changing the setting of the level controls, note the reading on the left meter and compare it with the first reading. The second reading will probably be higher. Continue this cycle of adjusting C-60, recording the tone, and playing it back until you reach a peak reading on the meter (maximum upscale deflection). When this occurs, note the DB reading on the meter.

REVERSE the direction of your adjustment on C-60 for ⅛ turn or less. Repeat the record-playback cycle until the meter reads 1DB below the peak valve. You now have the correct record bias voltage for the left channel.

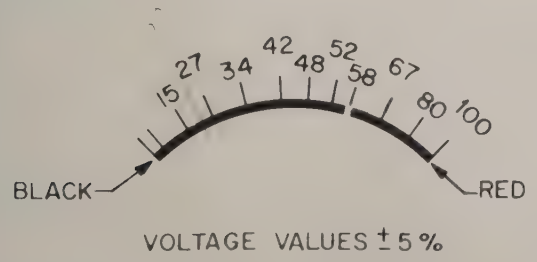
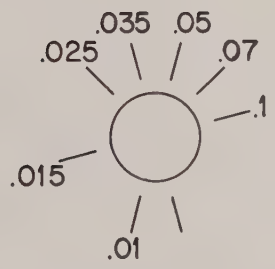


FIGURE 30.



RECORD CURRENT VALUES
FOR R-104 AND R-105

Repeat the above procedure for right channel record bias adjustment, using the controls and jacks marked with an R.
Adjust C-61 (R-BIAS) for the 1DB down point on the right meter.

ERASE CURRENT ADJUSTMENTS (Three head transports)
SEE FIGURE 27.

CONTROL SETTINGS

Selector switch in RECORD ST.
Monitor switch in SOURCE.
All LEVEL CONTROLS at zero.
Mult-normal-echo switch in NORMAL.
Bias switch in NORMAL.
Insert the pin jack with red/white wire in J-5. Insert the bare end of the red/white wire in terminal 3 of P-1.

Turn the adjusting screw of C-62 (Left erase) all the way in. Now back off on the adjusting screw about seven turns.

Turn the power on and start the transport.

Advance the L AUX LEVEL control until the left meter reads approximately 0 DB. You should hear a 120 cycle tone in your speaker.

Record this tone on the tape for about thirty seconds.
Stop the transport.
Turn the selector switch to any of the PLAY positions.
Rewind the tape to the beginning.
Turn the SELECTOR switch to RECORD ST.

Turn to Page 39

Place the MONITOR switch in TAPE.
Reduce L aux level control to zero.
Start the transport and advance the L PLAYBACK LEVEL control for loud volume.

Turn the adjusting screw on C-62 inward until the tone becomes faint.

Advance the PLAYBACK LEVEL control to maximum and continue adjusting C-62 until the tone completely disappears. When you reach this point, give C-62 an additional ¼ turn to insure complete erasure. You now have the proper erase current for the left channel.

Stop the transport and rewind the tape to the beginning.

RIGHT CHANNEL ERASE

Remove the pin plug from J-5 and insert in J-6. Make sure the red/white wire is still in P-1.

Repeat the procedure just outlined using the RIGHT CHANNEL meter and LEVEL controls.

Adjust C-63 (Right erase) for complete erasure on the right channel.

ERASE CURRENT ADJUSTMENTS (two head transport).
CONTROL SETTINGS

Selector switch in RECORD ST.
Monitor switch in SOURCE.
All level controls at zero.
Mult-normal-echo switch in NORMAL.
Bias switch in NORMAL.
Two head adapter switch in RECORD.
Insert the pin jack with red/white wire in J-5 (left record).
Insert the bare end of the red/white wire in terminal 3 of P-1.
Turn the adjusting screw on C-62 (L ERASE) all the way in. Now back off on the adjusting screw about seven turns.
Turn the power on and start the transport.
Advance the left aux level control until the left meter reads approximately 0 DB. You should hear the 120 cycle tone in your speaker or headphones.
Record this tone on the tape for 30 seconds then stop the transport.

Turn the selector switch to any of the PLAY positions.
Rewind the tape at the beginning.
Remove the cable from J-1, (left playback jack) at the preamp.

Remove the cable from J-7, (left record jack) at the preamp and insert it in J-1 at the preamp.

This allows you to monitor the tape for proper adjustment of the erase current.
Place the selector switch in RECORD ST.
Place the monitor in TAPE.
Reduce the left aux level control to zero.
Start the transport and advance the left playback level control for loud volume.

Turn the adjusting screw on C-62 inward until the tone becomes faint. Advance the playback level control to maximum and continue adjusting C-62 until the tone completely disappears. When you reach this point, give C-62 an additional quarter turn to insure complete erasure. You now have the proper erase current for the left channel.
Stop the transport and rewind the tape to the beginning.
Reinsert the cables in their proper jacks.

RIGHT CHANNEL ERASE ADJUSTMENT.

Remove the pin plug from J-5 and insert it in J-6. Make sure the red/white wire is still in P-1.
Repeat the procedure just outlined using the right meter, jacks and level controls.

Adjust C-63 (right erase) for complete erasure on the right channel.

EQUALIZATION

Turn the adjusting screws on C-69, C-70, C-71 and C-72 all the way in. Now back off on each adjusting screw for 1 full turn. This adjustment brings the frequency response of the preamp out to approx. 12KC at 7½ IPS and approx. 8KC at 3¾ IPS.

OSCILLATOR BALANCE, R-41
CONTROL SETTINGS

Selector switch in RECORD ST.
Monitor switch in TAPE.
Playback level controls at MAXIMUM.
Mic level controls at ZERO.
Aux level controls at ZERO.

Turn the power on and start the transport.
Adjust R-41 (Figure 27) until the hiss level is equal and at a minimum in both headphones or speakers.

ADJUSTING THE RECORD BIAS, ERASE CURRENT AND EQUALIZATION WITH AN AC VTVM AND AUDIO OSCILLATOR.

RECORD BIAS
SEE FIGURE 31

Solder the ground side of a pin plug to one of the leads on a 100Ω precision resistor (5% or better). Solder the ground side of a pin jack to the other lead.

Solder one end of an insulated wire to the center terminal of the pin plug. Solder the other end of the wire to the center terminal of the pin jack.

Insert the pin plug in one of the RECORD HEAD jacks at the transport.

Insert one end of a shielded cable in the pin jack attached to the resistor. Insert the other end of the cable in J-7 or J-8 on the tape preamp. Be sure to use the same channel on the preamp and transport.

Place the selector switch in RECORD ST.

Turn on the AC power at the preamp.

From the manual supplied by the manufacturer of your tape transport, determine the correct bias current for your record head.
Using the formula I x R = E, the voltage drop across the 100Ω resistor that gives the correct bias current can be calculated.
Where: I = recommended bias current in amperes.
R = 100Ω resistor
E = voltage drop across R
The AC VTVM used for this measurement must be capable of reading .01 volts or less.
Connect the meter probes across the resistor as shown and adjust the appropriate trimmer capacitor (C-60 or C-61) until the reading on the VTVM indicates the calculated voltage.

EXAMPLE:
Suppose the specifications for your transport state that a .5 ma of bias current (.0005 amps) is required for proper operation of the record head.

Calculate the voltage the VTVM must indicate when a .5 ma of current is flowing through the record head.

I x R = E; .0005 amp x 100Ω = .05 volts.

Connect the VTVM across the resistor and adjust C-60 or C-61 until the VTVM reads .05 volts.
Set the bias switch to READ BIAS and note the voltage indicated on the meter of the tape preamp. See Figure 30.
Adjust the trimmer capacitor of the other channel for the same voltage.
You now have the correct bias voltage for the record head on each channel.

ERASE CURRENT
SEE FIGURE 31

Substitute a 10Ω resistor (5% or better) for the 100Ω resistor used in the record bias adjustment.

Insert the pin plug attached to the resistor in one of the erase head pin jacks at the tape transport.

Connect one end of a cable to the pin jack attached to the resistor.
Connect the other end of the cable to J-9 or J-10 at the tape preamp.
Be sure you are using the same channel on the preamp and transport.

Consult the manufacturers specifications of your transport for the correct erase current.
Using the same formula outlined for the record bias adjustment, calculate the voltage drop across the 10Ω resistor (I x R = E).

I = recommended erase current in amperes.
R = 10Ω
E = voltage drop across R

Connect the meter probes across the resistor and adjust the appropriate trimmer capacitor (C-62 or C-63) until the reading on the VTVM indicates the calculated voltage.

EXAMPLE:
The recommended erase current for your transport is 15 ma (.015 amp). Calculate the voltage that the VTVM must indicate when 15 ma of current is flowing through the erase head.

I x R = E; .015 amp. x 10Ω = .15 volts. Adjust C-62 or C-63 until the VTVM indicates .15 volts. You now have the proper erase current for one channel.
Repeat the above procedure to adjust the remaining channel for the proper erase current.

EQUALIZATION

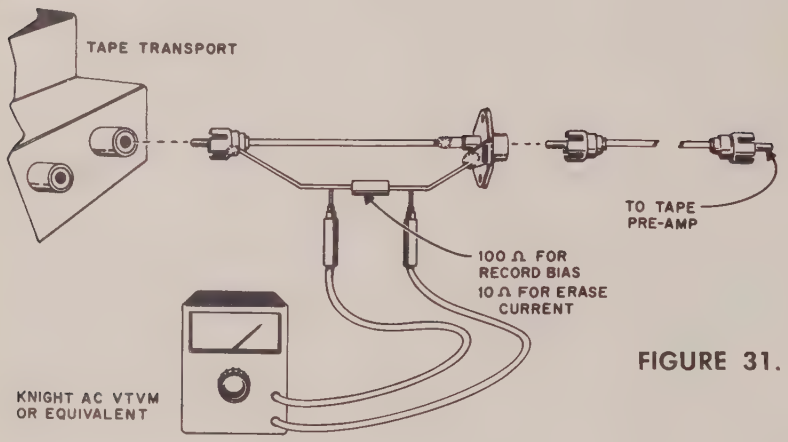


FIGURE 31.

EQUALIZATION ADJUSTMENT WITH OSCILLATOR AND VTVM

The purpose of equalization is to accentuate the high frequency response of the record amplifiers to compensate for the high frequency roll off of record heads. Because this roll off (loss of highs) will vary with the tape head used, the equalization circuits are adjustable. This allows you to tailor the record amplifiers to your record heads for maximum frequency response.

7½ IPS TAPE SPEED

Connect the tape transport to the tape preamp.
Connect the VTVM to the left output on the preamp, J-2.
Connect the output of an audio oscillator (approx. .5 V) to the left aux input on the preamp, J-5.
Set the oscillator at 1KC.

CONTROL SETTINGS

Selector switch in RECORD L.
Monitor switch in SOURCE.
Mult-normal-echo switch in NORMAL.
Equalization switch in 7½ IPS.
Bias switch in NORMAL.
Adjust the gain control on the oscillator and left aux level control for a reading of about —10 DB on the left meter.
Reset the monitor switch to tape.
Start the transport at 7½ IPS.
Adjust the left playback level control until the VTVM reads 0 DB on the highest possible range.

Stop the transport.
DO NOT CHANGE THE GAIN CONTROL ON THE OSCILLATOR OR THE LEVEL CONTROLS ON THE PREAMP WHEN MAKING THE FOLLOWING ADJUSTMENTS.

Turn the adjusting screws on the four equalization capacitors all the way in (C-69 to C-72).

Start the transport.

Slowly increase the FREQUENCY of the oscillator until the VTVM drops 3 DB or more from your 0 DB reference. See figure 39. (The meter pointer will rise to a small value above 0 DB before it starts to decrease).

With the transport still going, adjust C-72 until the VTVM reads approximately 0 DB.

Advance the frequency of the oscillator until the reading on the VTVM again drops to a value greater than 3 DB below your zero reference.

Adjust C-72 until the VTVM reads approximately 0 DB.

Continue increasing the oscillator frequency and adjusting C-72 until the VTVM can no longer be restored to the zero reference.

You now have the proper equalization for the left channel at 7½ IPS.

For equalization of the right channel at 7½ IPS, repeat the above procedure while adjusting C-70 for your zero reference. Use the RIGHT channel controls and jacks.

3¾ IPS TAPE SPEED

CONTROL SETTINGS

Equalization switch in 3¾.
Transport speed 3¾.
Follow the procedure outlined for 7½ IPS.
Adjust C-71 for left channel equalization.
Adjust C-69 for right channel equalization.

If your transport has two heads instead of three, equalization adjustment remains the same with one exception. You must rewind the tape after you record a signal then place the preamp in PLAYBACK to note the readings on the VTVM.

YOUR GUIDE
to
Tape Recording

MONITOR switch. This switch, when in the SOURCE position and using a three head tape transport, allows you to listen to the signal as it is being recorded. When the switch is in the TAPE position, it allows you to hear the signal after it has been recorded. By alternating this switch between its positions you can compare the quality of the input and output signals. This operation is called A-B monitoring and is a very desirable feature for making professional quality recordings.

R. MONITOR jack (right channel). This jack provides you with a sample of the signal being recorded or played back on the right channel, (depending on the setting of the MONITOR switch). The signal strength at this jack is strong enough to drive a pair of crystal (high impedance) headphones or an amplifier.

L. MONITOR jack (left channel). Same as above, but for left channel. If your stereo headphones are terminated in a single phone plug, insert the plug in this jack. Both channels will be heard.

R. PLAYBACK LEVEL. This control varies the volume of the right playback channel.

L. PLAYBACK LEVEL. Same as above, but for left playback channel.

SELECTOR switch. By rotating this switch through its various positions you can record or playback on either the left or right channel independently (monaural) or both channels simultaneously (stereo).

LEFT REC METER. This meter gives you a visual indication of the volume level at which your recordings are being made or played back.

RIGHT REC METER. Same as above, but for right channel.

R. AUX LEVEL. Controls the volume of program material being fed into right AUX input jack located on back of chassis.

L. AUX LEVEL. Same as above, but for left channel.

R. MIC LEVEL. Controls volume of signal being recorded from right microphone input jack.

L. MIC LEVEL. Same as above, but for left record channel.

L. MIC INPUT. Low level input jack for left record channel. Microphones with high outputs should not be used.

R. MIC INPUT. Same as above, but for right channel.

POWER-ON switch. Controls the AC power to the tape electronics and the two AC receptacles on the back of the chassis.

EQUALIZATION switch. When this switch is set to the speed at which the tape transport is operating, proper tone balance is maintained.

MULT-NORMAL ECHO switch (MODE). The mode of recording is selected by this three position switch. MULT allows you to make multiple (sound on sound) recordings, NORMAL allows ordinary unaffected recordings and ECHO allows an echoing effect to be incorporated on the signal. This switch will function only with tape transports having three heads.

USING THE RECORD LEVEL METERS

The record level meters will give you a visual indication of the strength of the signal being recorded on each channel. Figure 32 illustrates the area in which the meters should be operated for good quality recordings. The numerals above the scale divisions represent units of volume above and below a zero reference level.

The best recordings are made when the meters fluctuate around −10 VU (average record level) with occasional peaks to 0 or +1 VU. Recording levels higher than +1 VU can result in a distorted recording.

When the meters are used for monitoring on playback, the PLAYBACK level controls should be adjusted so the meter pointers do not strike the right side of the meters. This precaution will prevent meter damage or burn out.

USING THE LEVEL CONTROLS

The AUX, MIC, AND PLAYBACK level controls are the dual concentric clutch type. The action of these controls allow independent or simultaneous adjustment of each channel. To change the level of one channel without effecting the other, rotate the knob (inner or outer) corresponding to the channel whose level is to be changed while holding the remaining knob stationary. If you turn one of the knobs without holding the other, both knobs will turn simultaneously. This gives an equal and simultaneous change in level for both channels.

HEADPHONES

If you do not own a pair of stereo headphones, they can easily be made from a standard pair of crystal headphones by attaching a phone plug to the pair of wires coming from each ear piece.

TAPE SPEEDS

All through the demonstrations of this kit the tape speed will be 3¾ IPS. The reason for this is to shorten the time consumed in rewinding the tape and to expedite cueing, which you might have occasion to do.
When recording music it is advisable to use the higher 7½ IPS speed, although the recording time is halved as compared to the 3¾ speed, the frequency response, signal to noise ratio and stability of reproduction improve. This is true of any recorder—The faster the recording speed the better the recording.
If you plan to do any splicing and editing use the 7½ speed. The additional space between the recorded signal characters makes the task of editing less tedious.

MICROPHONE INPUTS

NOTE: The microphone inputs on your tape preamp are designed to accommodate high impedance microphones. However, microphones with lower impedances (150-250Ω) can be used but this necessitates using the mic gain controls at a higher level which could increase the hum and noise figure.

MONOPHONIC RECORDING AND PLAYBACK

For simplicity, the left channel is used to describe single channel operation, but it is understood that the right channel could be used equally well.

CONTROL SETTINGS

SELECTOR switch in RECORD LEFT.
MONITOR switch in SOURCE.
MODE switch in NORMAL.
EQUALIZATION switch in 3¾.
LEVEL controls at zero (fully counterclockwise).

Plug a headphone in the LEFT MONITOR jack.
Plug a microphone in the LEFT MIC input jack.

Talk into the microphone while holding it about 6″ from your mouth. Advance the LEFT MIC level control until the REC LEVEL meter indicates the recommended value (average record level). See Figure 32.
Start the tape moving past the heads on the transport at 3¾ IPS and continue talking. (If you can't think of anything to say, read some passages from a book or newspaper.) After you have recorded a few feet of tape, stop the tape transport.

PLAYBACK

SELECTOR switch in PLAYBACK left.
MONITOR switch to TAPE.
Rewind the tape to the beginning.
Start the tape transport and advance the LEFT PLAYBACK level control for a comfortable listening level. You will hear what you recorded in the left headphone. The LEFT REC LEVEL meter will operate also.
Monophonic recordings for the right channel are made in the manner just outlined. Use the controls, jacks and switches marked with an R.

PLAYBACK THROUGH HI-FI SYSTEM

To play back the recording through a speaker instead of the headphones, connect the PLAYBACK OUTPUT of the left channel to a high level input (Tuner, Aux, Tape) on your Hi-Fi amplifier or preamplifier. Note: THE TAPE HEAD INPUTS, on preamps are low level and should not be used.

The PLAYBACK OUTPUT also be connected directly to the input of a basic power amplifier.

ERASE

To erase a signal off either or both channels, set the SELECTOR switch in the RECORD position corresponding to the channel being erased. (ST for both channels). Turn the MIC and AUX level controls to zero for minimum noise and start the tape transport. When you have finished, the tape channel(s) that were erased will be blank.

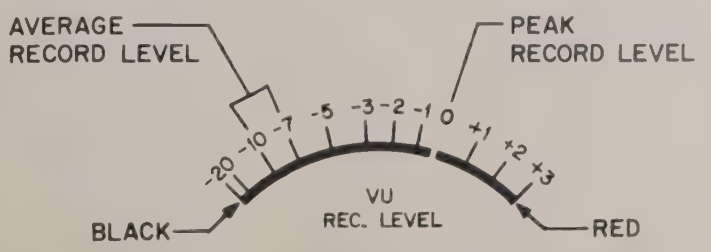
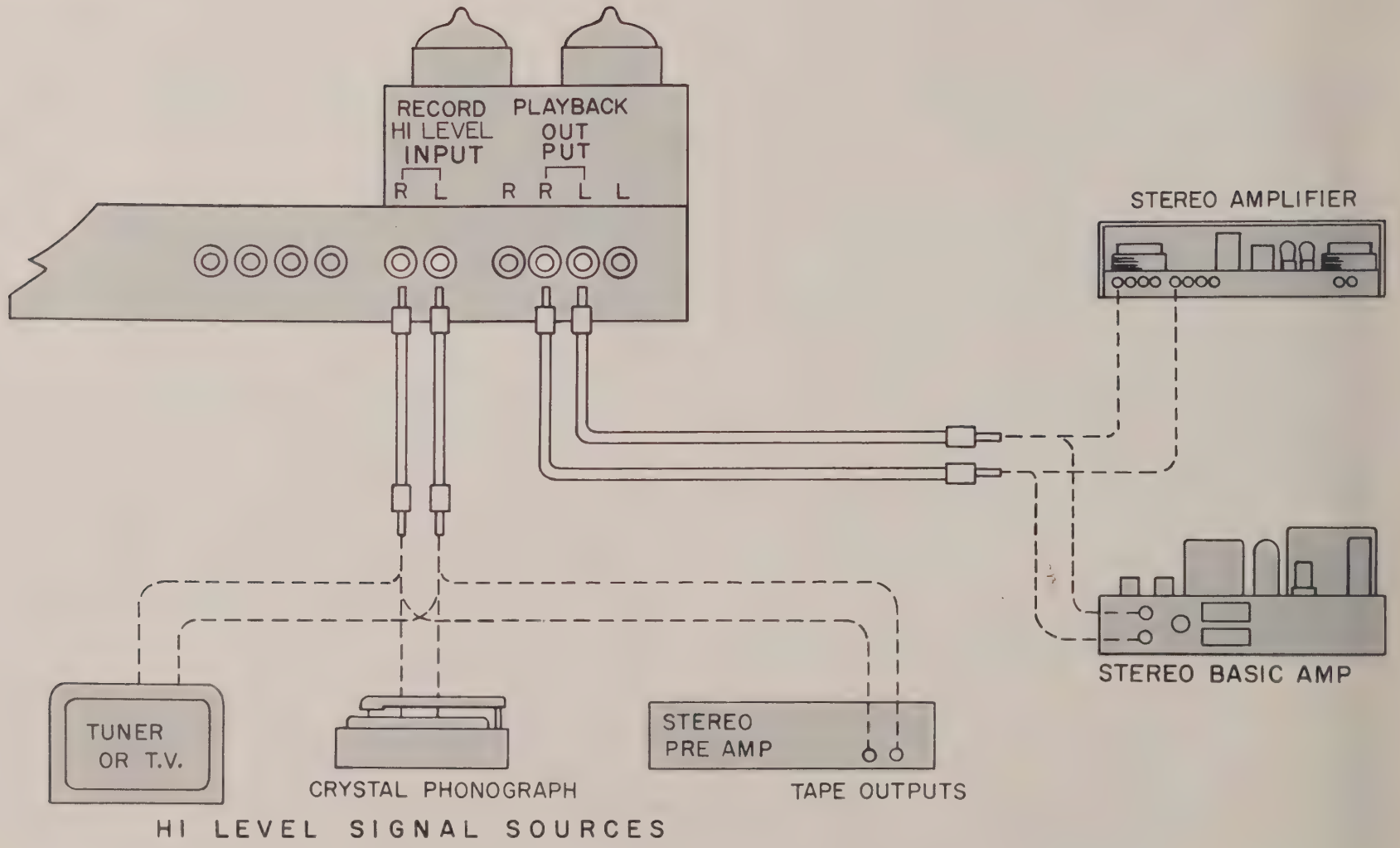


FIGURE 32.

FIGURE 33.


RECORD
HI LEVEL
INPUT
R L
PLAYBACK
OUT
PUT
R R L L
STEREO AMPLIFIER
STEREO BASIC AMP
TUNER
OR T.V.
CRYSTAL PHONOGRAPH
STEREO
PRE AMP
TAPE OUTPUTS
HI LEVEL SIGNAL SOURCES

AUX INPUTS

To make a recording using the aux inputs it is necessary to have a signal source with a high output (.1 V or higher). Examples of such signal sources are: tuners, television receivers, ceramic cartridge phonographs, another tape recorder, or any signal taken from the RECORDER OUTPUTS of a Hi-Fi amplifier.
To make a recording from any one of these sound sources, connect its audio output to one of the AUX input jacks on the tape preamp and set the controls as follows:

SELECTOR switch in RECORD LEFT or RIGHT, depending upon which aux input you are using.
MONITOR switch in SOURCE.
MODE switch in NORMAL.
All level controls fully counterclockwise.
Plug a headphone in the MONITOR jack corresponding to the channel being used.
Advance the appropriate AUX LEVEL control until a signal is heard in the headphone and the record meter indicates the proper value. If you cannot hear any sound, increase the volume of the signal source.
After you are satisfied that the record level is within the tolerance specified for good quality recordings, start the tape transport.

PLAYBACK

After you have completed the recording, stop the tape transport.
Set the SELECTOR switch in the proper PLAYBACK position.
Rewind the tape to the beginning.
Set the MONITOR switch in TAPE.
Plug the headphone in the proper MONITOR jack.
Start the tape moving past the tape heads and adjust the PLAYBACK level for a comfortable listening level.
It is not necessary to disconnect the signal source from the tape preamp.

SEE FIGURE 33.

HOW TO CONNECT HIGH LEVEL SIGNAL SOURCES DIRECTLY TO THE TAPE PREAMP.

Tuner — Connect the audio outputs (usually located at the back of the tuner) to the AUX inputs in the tape preamp.

Ceramic phono — Plug the coaxial cable coming from the phonograph into the AUX inputs.

Radio or television receiver — There are few AM radio or television receivers equipped with audio output facilities, so you will probably have to make a connection directly at the loudspeaker. This is usually a simple task and the connection can become a permanent one if you wish. See Figure 34. To make a temporary connection, use alligator clips instead of soldered connections. Cables designed for this purpose are easily obtained.

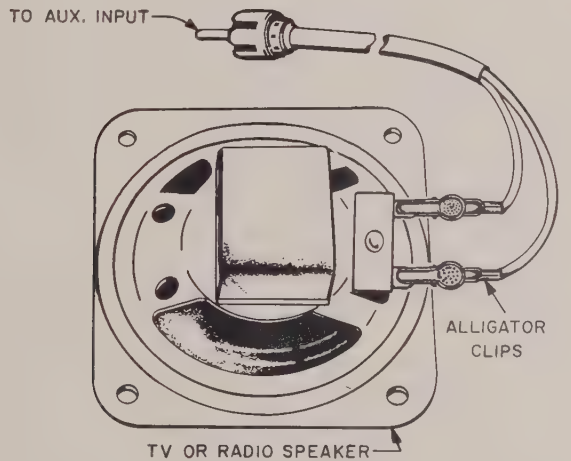


FIGURE 34.

One of your best sources of good music is an FM tuner. By becoming aware of FM program listenings you can record volumes of good music for a fraction of the cost of comparable disc recordings.

USING THE TAPE OUTPUT OF A HI-FI AMPLIFIER

If your amplifier has a tape output, any program source that is being played through the amplifier can be recorded on tape. Connect a shielded cable between the tape output of the amplifier and the AUX input on the tape preamp. Usually volume and tone adjustments on the amplifier have no effect on signals at the tape output.

MIXING

SEE FIGURE 35.

The mixing of two independent signals on one channel is accomplished by feeding a high level signal into one of the AUX inputs and a low level signal into its complementary MIC input and adjusting their respective level controls for the desired volume combination.

SELECTOR switch in RECORD LEFT.

MONITOR switch in SOURCE.

MODE switch in NORMAL.

LEVEL controls at zero.

Plug a headphone in the L MONITOR jack.

Plug a microphone in the L MIC input jack.

Connect a ceramic phono to the L AUX input jack (magnetic, reluctance or other low output cartridge phonos may be used, but they must first go through a preamplifier).

Place a record on the turntable (preferably one that is familiar to you). Start the record playing and adjust the AUX L level control for a comfortable listening level. While monitoring the music with the headphone, sing or hum into the microphone, adjusting the MIC L level control for an acceptable balance between the music and your voice.

When you are satisfied with the balance, start the tape transport and complete the recording. Playback is accomplished in the way explaned previously.

Notice, by changing the volume balance between your voice and the music from the record, the coloring or perspective of the recording will vary greatly. Maintaining the proper perspective on multi-signal recordings requires some practice, but is worth the effort if you plan to make any serious recordings.

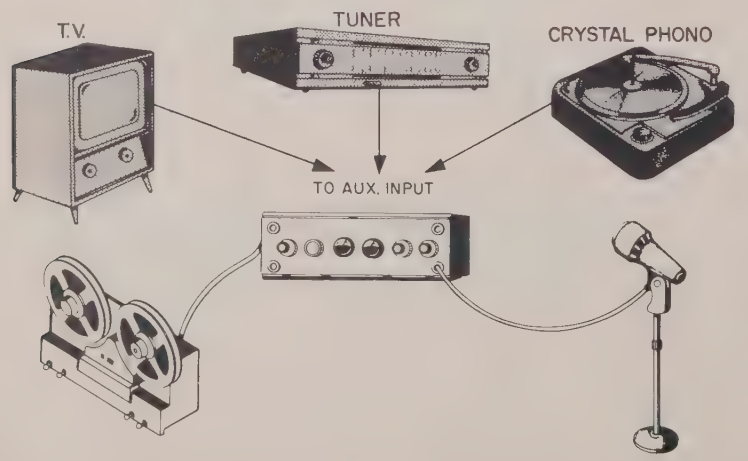


FIGURE 35.

ECHO RECORDINGS

ECHO EFFECT

SELECTOR switch in RECORD LEFT.

MONITOR switch in SOURCE.

MODE switch in ECHO.

LEVEL controls at zero.

Start the tape transport.

As you speak into the microphone, advance the LEFT PLAYBACK level control until the echo effect becomes apparent. If you continue advancing the playback level the echo will become more pronounced and finally break into oscillation.

Change the tape speed on the deck and the equalization switch on the tape electronics to 7½ IPS. Notice that the echo has become tighter, that is, it has a shorter delay.

After you have finished recording, stop the transport. Turn the selector switch to LEFT PLAYBACK and rewind the tape. Set the monitor switch to TAPE and the mode switch to NORMAL.

Start the tape transport. You will hear the echo effect in the left headphone.

ECHO is used to add dimension to a recording. If used sparingly, it can add body to a tone or voice that otherwise would be thin and wispy. If used in larger amounts it produces a dramatic affect by adding importance and depth to music or voices. This echo effect can be applied to any signal source—microphone, tuner, TV, phono, etc. Some television commercials can receive very humorous treatment when recorded with echo.

FIGURE 36.

MULTIPLE RECORDINGS

SEE FIGURE 37.

Because a good quality multiple (sound on sound) recording, at best, is a complex operation, we strongly urge you to practice the procedure outlined below. After a few practice runs, you will get the "feel" of it and as your confidence grows so will your ability to apply this useful feature.

PART 1

SELECTOR switch in RECORD LEFT.

MONITOR switch in SOURCE.

MODE switch in NORMAL.

EQUALIZATION switch in 3¾.

LEVEL controls at zero.

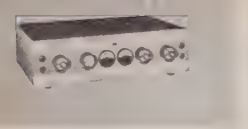
Rewind the tape. Plug the left headphone in the LEFT monitor jack. Plug a microphone in the LEFT MIC input.

Speak into the microphone and adjust the LEFT MIC level until you receive the proper deflection on the left meter.

The example we will use to demonstrate a three part recording will be a count—ONE-TWO-THREE—with a different number being inserted in the tape for each part of the recording.

In the first part of the recording, recite the word ONE out loud, but silently continue the count to three, leaving a short pause between each number. When you reach three, start over. Repeat this procedure about ten times.

EXAMPLE: ONE-two-three-ONE-two-three-ONE-two-three, etc. Start the tape. Count into the microphone saying the number ONE out loud and the rest silently.



When you have done this about ten times stop the tape. Disconnect headphone and microphone.

Turn the selector switch to any of the PLAYBACK positions, to prevent accidental erasure, and rewind the tape to the beginning.

PART 2

SELECTOR switch in RECORD RIGHT.
MONITOR switch remains in SOURCE.
MODE switch to MULT.

Do not change the setting of the LEFT MIC level control.
Plug the right headphone in the RIGHT MONITOR jack.
Plug a microphone in the RIGHT MIC input jack.

Start the tape and adjust the LEFT PLAYBACK level control until you receive the recommended deflection on the RIGHT meter.

You should hear the word ONE being repeated in the headphone with a long pause between each word.

Say the word TWO into the microphone and adjust the RIGHT MIC level control for a meter deflection equal to the one being received. When you are satisfied that the levels of the two signals are equal, stop the tape and rewind to the beginning.

Start the tape and record the word TWO just after you hear the word ONE in the right headphone. Repeat this procedure ten times being careful to allow enough space on the tape to insert part 3.

When you have completed part 2 stop the tape. Disconnect the headphone and microphone.

Turn the selector switch to any of the PLAYBACK positions and rewind the tape to the beginning.

PART 3

SELECTOR switch in RECORD LEFT.
MONITOR switch remains in SOURCE.
MODE switch remains in MULT.

Do not change the values of the LEVEL controls previously set.
Plug the left headphone in the LEFT MONITOR jack.
Plug a microphone in the LEFT MIC input jack.

Start the tape and adjust the RIGHT PLAYBACK level control until you receive the recommended deflection on the left record meter. You should also hear the words ONE TWO in the headphones with a slight pause after TWO.

Say the word THREE into the microphone and if necessary, touch up the LEFT MIC level control for proper balance. Rewind the tape to the beginning.

Start the tape deck and record the word THREE on the tape just after you hear the word TWO in the headphone.

After you have completed recording the last part of this three part recording, turn the selector switch to PLAYBACK LEFT. Set the monitor switch to TAPE and rewind the tape to the beginning. Disconnect the microphone and play the tape.

By following the procedure just outlined, as many parts as desired may be inserted in the tape.

One of the most practical examples of multiple recording lies in the field of education. A speech instructor or musician will record a lesson on tape which the student must duplicate. The student, taking advantage of the multiple recording feature, can monitor the lesson while simultaneously recording his version along with the original. On playback, an instant-note for note, syllable for syllable-comparison can be made to check the students progress. Because the original recording remains intact, this process may be duplicated by the student as many times as he needs to memorize the material.

STEREOPHONIC RECORDINGS

One of the most rewarding features your Knight tape preamp has to offer in terms of pure entertainment is its ability to record and playback stereophonically.

A stereophonic recording adds a third dimension to the sound which gives the illusion of depth or presence as opposed to the comparatively flat sound of a monophonic recording.

If the program material to be recorded is of simple construction, such as a panel discussion, sound effect, or a small musical combo, a professional sounding stereo recording can be made with very little practice.

To make a stereo recording, two performers are needed.

RECORDING
SELECTOR switch in RECORD STEREO (ST).
MONITOR switch in SOURCE.
MODE switch in NORMAL.

Plug a microphone into each of the MIC INPUT jacks, left and right. Place the microphones about the same distance apart as the playback speakers, approximately 6 feet.

Plug the stereo headphones into the MONITOR jacks making sure the left phone plug is in the left jack and the right plug is in the right jack. (For stereo phones with a single plug, use the LEFT MONITOR jack).

Because BOTH record channels are used simultaneously when making a stereo recording, the volume level for each microphone becomes important if a good BALANCE between channels is to be attained.

Place the performers at their respective microphones and have them give you a LEVEL. That is, have them start their performance so you can adjust the INPUT LEVEL controls for proper volume balance between microphones. (Ordinary conversation between the performers will do if musical skill is not available). Proper balance is attained when the performance, as heard in the monitor phones, is most natural.

Once the balance is established it is maintained by the clutch action of the level controls.

Start the tape transport and have the performers start their performance from the beginning.

Your only duty now is to "ride gain". That is, keep the overall volume within the specified tolerance as insurance against distortion and background noise (black area on the meter).

After the performance has been completed, stop the tape transport.

PLAYBACK

SELECTOR switch in STEREO PLAY.
MONITOR switch in TAPE.
MODE switch remains in NORMAL.

Rewind the tape to the beginning.

Connect the PLAYBACK outputs of the tape preamp to the TAPE INPUTS of your stero sound system. See figure 34. If TAPE INPUTS are not provided, any of the high level inputs will serve just as well (tuner, aux., etc.).

Start the tape transport and adjust the volume and tone controls for the most pleasing sound.

Start the tape transport and adjust the PLAYBACK level controls for a comfortable listening level.

This stereo tape recording can also be played monophonically by feeding the two PLAYBACK outputs from the tape preamp into any high level input jack on monophonic amplifiers. Stereophonic to monophonic adapters are available for this purpose.

If you have pre-recorded stereo tapes, use the playback procedure just outlined.

DUAL CHANNEL RECORDING

This feature allows you to simultaneously record two unrelated signals, such as a sports event and a symphony, and independently or simultaneously play them back without interferring with each other.

A dual channel recording is made in exactly the same manner as a stereo recording except that you need not concern yourself with CHANNEL BALANCE. The speakers used on playback must be isolated from each other if both channels are played back simultaneously.

A more common application of dual channel is the recording of an event on one channel (convention, speeech, symphony, panel discussion, etc.) with a running narration being recorded on the other. This narration can be recorded simultaneously with the event or recorded later at a more convenient time.

FUNCTION OF PLUG P-1

ACCIDENTAL ERASURE

To prevent accidental erasure of recorded materials such as pre-recorded tapes, plug P-1 may be removed from its socket at the back of the chassis. By removing this plug, the bias oscillator is disconnected from the rest of the unit, effectively eliminating the record and erase features. To reactivate the record and erase heads, reinsert the plug in its socket.

REMOTE CONTROL OF RECORD AND ERASE HEADS

By wiring a NORMALLY OPEN switch to plug P-1, such as a push button or erase lockout switch (if your transport is equipped with one), the operator can remotely control the erase and record circuits by opening and closing the switch.

This feature allows the operator to erase unwanted portions of a signal without disturbing the rest of the recording. He may also simultaneously record a new signal over that portion being erased.

It is suggested that a second P-1 plug be purchased if this feature is to be used.

To wire the switch to P-1, connect an insulated wire, of any convenient length, to each of the terminals on the switch. Solder the free ends of these wires in terminals 1 and 2 of plug P-1.

As an example, suppose you have recorded on the left channel, a narration of a sports event, convention or meeting that had been previously recorded on the right channel. On playback, you discover that your recorded narration could be improved at certain points. To make these improvements, remove plug P-1 from J-11 and insert the plug with the switch attached. Rewind the tape to the beginning.

Insert a headphone in the LEFT MONITOR channel.
Insert a microphone in the LEFT MIC CHANNEL.
MIC LEVEL control set at the same value as the original recording.
SELECTOR switch in RECORD LEFT.
MONITOR switch in TAPE.

Start the tape transport and adjust the LEFT PLAYBACK level control for a comfortable listening level in the headphone.

When you come to that portion of the narration that needs improvement, stop the transport. Rewind the tape to a point where the first word of the passage to be corrected is in line with the pole pieces of the erase head. Close the switch. Start the tape transport and insert the correction. After you have completed the insertion release the switch. If the switch is held closed longer than necessary, wanted portions of the narration might be erased. Continue monitoring the left channel until you reach the next point of correction. Repeat the above procedure. When you have finished, remove the plug and switch and reinsert plug P-1 (with red wire) in J-11.

SPLICING

To make a noiseless tape splice follow the illustrations in Figure 39.

1. Overlap the loose ends of the tape, shiny sides up. With a pair of unmagnetized scissors, cut the ends of the tape at a 45° angle.
2. Place the tape on a clean surface, shiny sides up. Butt the ends of the tape together and place a length of splicing tape over the butt joint as shown.
3. Slightly undercut the edges of the tape at the splice. This prevents the splice from sticking to adjacent layers of tape after it is wound on the reel.

If you plan on doing extensive splicing or editing the purchase of a tape splicer would be a worthwhile investment.

TAPE CARE

Good quality acetate or mylar base tape present practically no problems in handling or storage. If the temperature of the storage area is kept at approximately 70° F and the humidity at around 50 or 60 per cent, the quality of the tape will not be impaired.

The tape timing chart gives you the playing time for each size reel. L.P. means long play mylar tape. STD means standard thickness tape.

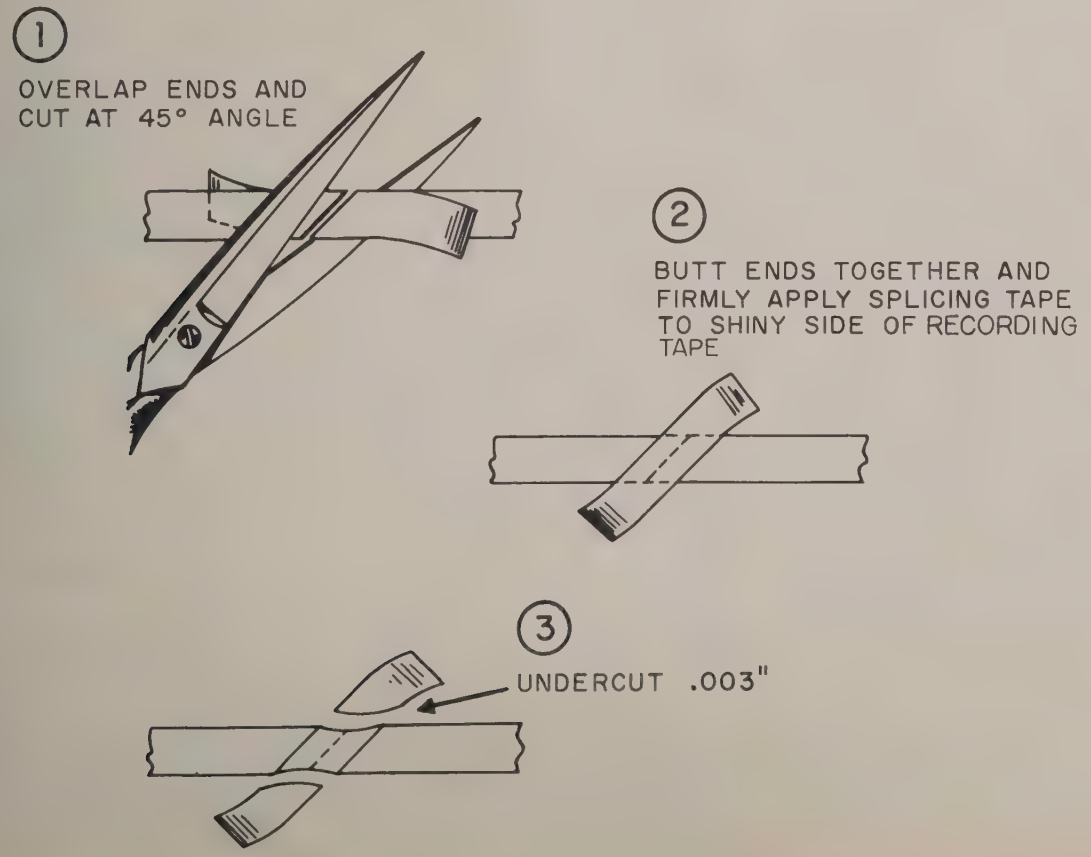


FIGURE 37.

SPECIFICATIONS

PLAYBACK SECTION

Frequency response	± 2 db from 18 cycles to 22KC
Equalization	NAB @ 7½ IPS; separate equalization for 3¾
Harmonic distortion	0.3% @ 2v out

RECORD SECTION

Input sensitivity	0.5 mv at microphone inputs and 80 mv at aux. inputs (tuner, etc.) for maximum record level
Record distortion	Less than 0.3% at maximum record level for both channels
Bias oscillator	65KC; voltage internally adjustable to match head.
Overall frequency response w/Knight KN 4000 tape transport	7½ IPS ± 3 db from 30 cycles to 15KC; 3¾ IPS ± 3 db from 50 cycles to 10KC.
Hum and noise	Better than 45 db below recording level.
Tubes and diodes	4-12AT7; 4-12AX7; 1-12BH7; 6 silicon diode rectifiers.
Power consumption	35 watts 115V AC
Size	15½" wide, 9½" deep, 4⅛" high, less/cover
Shipping wt.	15 pounds
Equalization	Variable: 3¾ 7.5KC — 9KC 7½ 10.5KC — 12.5KC
Rec current	Variable: .025 — .1MA

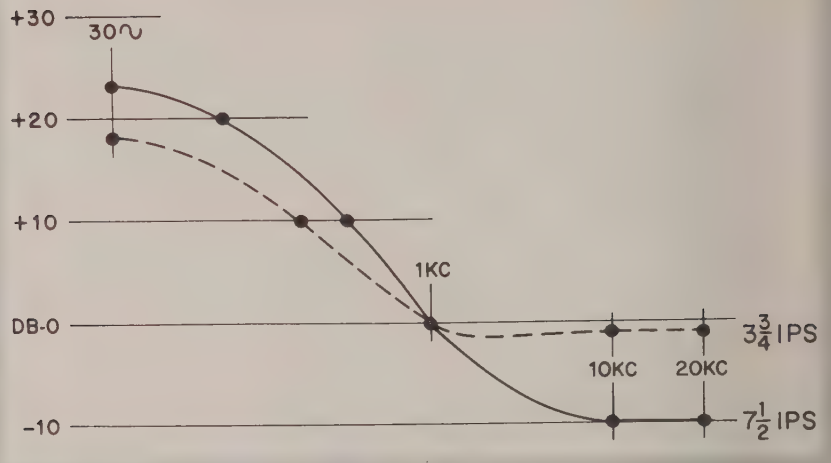


FIGURE 38.

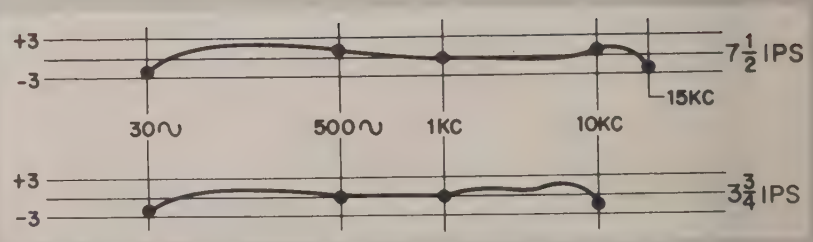


FIGURE 39.

By following the arrows on the block diagram, the function of all important controls can be easily understood. For simplicity, signal paths for the left channel will be described whenever possible, although they may be applied just accurately to the right channel.

PLAYBACK

SELECTOR switch S-1 in LEFT PLAYBACK position
MONITOR switch S-2 in TAPE position
As the pre-recorded tape is pulled past the playback head, the signal, stored on the tape in the form of small magnetic charges, is induced into the playback head and fed through two stages of pre-amplification, V-1A and V-1B. The signal is then passed through a gain control and into the output amplifier V-2A, where it is amplified enough to drive a pair of headphones or a power amplifier. As the signal reaches the contacts of the monitor switch it divides; part of it reaches the output jacks and part of it is directed toward the meter amplifier V-2B, where it is amplified once again to operate the level meter.

RECORD (normal)

SELECTOR switch in LEFT RECORD position
MONITOR switch in SOURCE position
S-3 switch in NORMAL position
A high level audio signal fed into the AUX input (crystal phono, tuner, TV, etc.) is passed through a level control and into record amplifier V-6A and V-6B, where it is amplified enough to energize the record head.
If a low level signal source is to be used (dynamic mic, etc.), it should be fed into the MIC input jack where it will receive the necessary pre-amplification from mic pre-amp V-5A and V-5B. The signal then passes through its level control and into the record amp. At the record amp the signal is divided; part of it is sent to the record head to magnetize the tape as is is pulled past the pole pieces and part of it goes through the contacts of the monitor switch to the meter amplifier and output jacks.

MONITOR SWITCH

If the monitor switch is placed in the TAPE position, the recorded signal may be heard in the monitor headphones or speaker as it leaves the output amp. By moving the monitor switch from SOURCE to TAPE the quality of the signal recorded on the tape may be compared with the source.

RECORD (echo)

SELECTOR switch in LEFT RECORD position
S-3 in ECHO
MONITOR switch in SOURCE

When S-3 is moved to the ECHO position a direct signal path is established between the left playback output amplifier and the left record amplifier. This arrangement allows the signal coming from the playback head to be channeled through the various stage of amplification and back out the record head giving a reverberative (echo) effect to the signal. The amount of reverberation is determined largely by the setting of the playback gain control, although tape speed and head separation will also influence the reverberation period.

RECORD (mult.)

SELECTOR switch in LEFT RECORD position
MONITOR switch in SOURCE
S-3 in MULT position
When S-3 is moved to the MULT position, a direct signal path is completed between the playback output amplifier of the left channel and the record amplifier of the right (black arrows). In essence, this transfers the signal recorded on the left tape track to the right, at the same time allowing you to dub in an additional part to the recording.
This is accomplished by amplifying the signal from the LEFT playback head, feeding it through the contacts of S-3 and into the RIGHT record amplifier V-8A and V-8B, where the signals are mixed. This composite signal is then sent to the RIGHT record head to be transfered to the tape. This signal is also sent to the RIGHT output jacks and level meter for monitoring purposes.

BIAS OSCILLATOR

The bias oscillator V-9A and V-9B, generates the 65KC signal needed for optimum efficiency in erasing and recording.
When the bias frequency from the erase head comes in contact with the oxide coating on the tape, it erases the signal by neutralizing the many small magnetic charges stored on the tape.
The bias frequency is applied to the record head to maintain a low noise, low distortion signal transfer from the head to the tape.
The bias circuits can be defeated by removing plug P-1. With P-1 disconnected the B+ voltage is removed from the plates of the oscillator tube causing the record and erase heads to become inoperative.

EQUALIZATION S-4 (See Schematic Diagram)

When a signal enters the left record channel at 7½ IPS, the higher frequencies are emphasized by L-3 and C-72 which forms a series resonant circuit that can be varied from 10.5KC to 17KC. As the incoming signal approaches the resonant frequency of this L-C combination the feed back

loop from V-8A to V-8B finds a low impedance path to ground. This reduction in feed back causes the higher frequencies to be amplified at a greater gain than the lower frequencies by V-8B. When the equalization switch is in 3¾, C-71 is paralleled with C-42 to lower the resonant frequency that can be varied from 8KC to 10.5KC.

Signals entering the right record channel are treated in the same manner. L-4, C-54, C-69 and C-70 form the equalization circuits for this channel.

Low Frequency equalization is accomplished in the left playback amplifier through a feed back loop, C-3, R-5 and R-93, connecting the plate of V-1B to the cathode of V-1A.

This feed back loop offers a low impedance to the higher signal frequencies causing them to be attenuated. At low signal frequencies, the impedance of this net work increases forcing the low frequency component to pass on to the next stage of amplification without attenuation.

When the equalization switch is in 7½, R-93 is shunted allowing a greater amount of high frequency attenuation. In the 3¾ position the shunt is removed from R-93 and high frequency attenuation is reduced.

C-19, R-30 and R-94 form the equalization circuit for the right playback channel.

POWER SUPPLY

The power supply is transformer operated from 105-125 volt AC current. It is fused with a ½ amp slo-blo fuse.

Silicon diodes E-1 and E-2 provide the B+ voltage needed for the plates of the tubes.

Silicon diodes E-3 to E-6 provide the high current DC used on all amplifier tube filaments.

Filament voltages for the pilot lamps and V-9 are derived from a separate 6.3 volt secondary winding on power transformer T-1.

BIAS SWITCH S-6

When S-6 is in the BIAS READ position, the voltage for the record head of each channel is read on the REC LEVEL meters. By adjusting C-60 and C-61, the record voltage can be varied to accommodate record head.

R-44 and R-95 act as a 1000 to 1 voltage divider for the right channel meter, and R-45 and R-96 form the voltage dividing network for the left channel meter.

SERVICE HINTS

SYMPTOM	HINT
POWER SUPPLY	
BLOWS FUSES	1. Check for shorts and wiring errors in power supply section.
TUBE FILAMENTS AND PILOT LAMPS DO NOT LIGHT	1. Check the voltages at the secondary winding of T-1. 2. Check wiring of pins 4, 5 and 9 on all tube sockets. 3. Check wiring of E-3, E-4, E-5 and E-6.
NO B+ VOLTAGE	1. Check wiring of E-1 and E-2.
HUM CONTAMINATION	1. Open shielded wires. 2. Bad solder connections at ground points. 3. Reverse the power plug in the AC outlet.
RECORD	
ONE OR BOTH CHANNELS WILL NOT ERASE	1. Check wiring of S-1, P-1, L-5 & V-9. 2. Check cable connections to tape transport. 3. Go through tune up procedure of C-62 and C-63.
DISTORTION AND TOO MUCH GAIN AT MIC INPUTS	1. Output from microphone too high. 2. Level control set too high. 3. Microphone held too close to mouth.
RECORD INDICATOR DOES NOT LIGHT	1. Check wiring of S-1A and NE2H.
ONE OR BOTH CHANNELS WILL NOT RECORD	1. Refer to hints 1 and 2 under ONE OR BOTH CHANNELS WILL NOT ERASE. 2. Go through tune up procedure of C-60 and C-61.
PLAYBACK	
ONE OR BOTH CHANNELS WILL NOT PLAYBACK	1. Check cable connections to tape transport. 2. Shorted input terminals or cable. 3. Check wiring of tubes, input and output jacks and wiring of S-1.

TAPE TIMING CHART

TAPE LENGTH IN FEET	4 TRACK STEREO		2 TRACK STEREO		4 TRACK MONOPHONIC		2 TRACK MONOPHONIC	
	7½ IPS	3¾ IPS	7½ IPS	3¾ IPS	7½ IPS	3¾ IPS	7½ IPS	3¾ IPS
150 STD. 3″ REEL	7½ min.	15 min.	3¾ min.	7½ min.	15 min.	30 min.	7½ min.	15 min.
225 L.P. 3″ REEL	11¼ min.	22½ min.	5⅝ min.	11¼ min.	22½ min.	45 min.	11¼ min.	22½ min.
300 STD. 4″ REEL	15 min.	30 min.	7½ min.	15 min.	30 min.	1 hr.	15 min.	30 min.
600 STD. 5″ REEL	30 min.	1 hr.	15 min.	30 min.	1 hr.	2 hrs.	30 min.	1 hr.
900 L.P. 5″ REEL	45 min.	1½ hrs.	22½ min.	45 min.	1½ hrs.	3 hrs.	45 min.	1½ hrs.
1200 STD. 7″ REEL	1 hr.	2 hrs.	30 min.	1 hr.	2 hrs.	4 hrs.	1 hr.	2 hrs.
1800 L.P. 7″ REEL	1½ hrs.	3 hrs.	45 min.	1½ hrs.	3 hrs.	6 hrs.	1½ hrs.	3 hrs.
2400 STD. 10½″ REEL	2 hrs.	4 hrs.	1 hr.	2 hrs.	4 hrs.	8 hrs.	2 hrs.	4 hrs.

RESISTANCE CHART

	PIN								
TUBE	1	2	3	4	5	6	7	8	9
V-1	260K*	1 meg	1K	0	10Ω	260K*	1 meg	1K	—
V-2	50K*	1 meg	5.2K	10Ω	8Ω	57K*	1 meg	680Ω	—
V-3	260K*	1 meg	1K	0	10Ω	260K*	1 meg	1K	—
V-4	50K*	1 meg	5.2K	10Ω	8Ω	57K*	1 meg	680Ω	—
V-5	242K*	0	1K	0	10Ω	142K*	10 meg	0	—
V-6	120K*	110K	1.5K	10Ω	8Ω	76K*	2.7 meg	2K	—
V-7	242K*	0	1K	0	10Ω	142K*	10 meg	0	—
V-8	120K*	110K	1.5K	10Ω	8Ω	76K*	2.7 meg	2K	—
V-9	340Ω*	27K**	480	0	0	340Ω	27K**	0	.5Ω

Make resistance readings with:
Power off
Selector switch in record stereo position
All gain controls at zero
Mode switch (S-3) in normal position
Reference to chassis ground

*Measured between terminal of C-27 and pins indicated
**Will vary with setting of R-41

ALLIED SERVICE FACILITIES

FREE INFORMATION SERVICE

First, write a letter to us if your wired kit does not operate properly. Address KNIGHT-KIT Dept. at Allied Radio. Give the stock number of the kit, date of purchase and describe the problem. In a great many cases our technicians can determine corrective steps from the information in your letter. This free information service may save you the expense and inconvenience of returning the kit for repairs.
Should it appear that work in our shop is necessary, we will send you a pre-addressed label and specific packing instructions for your kit.

SPECIAL INSPECTION SERVICE

You may return this wired KNIGHT-KIT for inspection and repair within one year after purchase for a special service charge of $10.00. An additional charge will be made for any parts damaged in construction or for parts beyond the EIA 90-day warranty period. Service charges for kits returned after the one year period will be based on the length of time needed to repair the unit plus the cost of any parts required.

PLEASE NOTE: Kits soldered with acid core solder, paste flux, or with irons cleaned on a sal ammoniac block are not eligible for repair or service because they have been permanently damaged by the acid flux.

PACKING INSTRUCTIONS

If you return this kit, pack it well. Do NOT use the original carton—it is too small for the assembled kit. To prevent damage in shipment, use a carton large enough so that cushioning material can be placed around the instrument. Cushion it well and tightly. Mark it: FRAGILE—DELICATE ELECTRONIC EQUIPMENT.

We recommend that this equipment be shipped ONLY by Railway Express, if at all possible, to forestall damage in shipment. Send the kit prepaid and insured. We will return the repaired kit to you C.O.D. as soon as repairs are completed. If you wish to save C.O.D. fees, your advance remittance may be enclosed for standard repair charges plus transportation costs. Any excess remittance will be refunded.

IF YOUR KIT ARRIVED DAMAGED

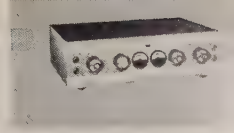
If your kit was damaged in a parcel post shipment, please write us at once, describing the condition in which the shipment was received. If your kit was part of a Railway Express shipment that was damaged in transit, please notify the local Railway Express agent at once and then write us.

KNIGHT-KIT GUARANTEE

Allied extends these firm guarantees on KNIGHT-KITS; all KNIGHT-KITS are sold with an exclusive money-back guarantee to meet or exceed published specifications and to perform exactly as specified or we refund your money.

In addition, we guarantee that only permium-quality components are selected for use in KNIGHT-KITS. Every KNIGHT-KIT component is fully warranted against defects in material and workmanship for a period of 90 days from date of original purchase. Should replacement parts be required under this warranty, notify us promptly, including sufficient details to identify the required parts. Parts will be shipped without charge. We reserve the right to request the return of defective parts.

PARTS LIST



CAPACITORS

Symbol Number	Description	Part Number
C-1	47 μμfd, Ceramic disc.	276479
C-2	.01 μfd, Ceramic disc.	276015
C-3	780 μμfd, Silver mica, 300 V. 1%	294002
C-4	.05 μfd, Ceramic disc.	275506
C-5	10-10 μfd, 300 W.V. electrolytic	234201
C-6	.05 μfd, Ceramic disc.	275506
C-8	.15 μfd, Standup type	209005
C-9	.05 μfd, Ceramic disc.	275506
C-10	50 μfd, 12V electrolytic	209002
C-11	.25 μfd, mylar	295004
C-12	.25 μfd, mylar	295004
C-13	50 μfd, 12V electrolytic	209002
C-14	.05 μfd, Ceramic disc.	275506
C-16	.15 μfd, Standup type	209005
C-17	.05 μfd, Ceramic disc.	275506
C-18	.05 μfd, Ceramic disc.	275506
C-19	780 μμfd, Silver mica, 300 V. 1%	294002
C-20	.01 μfd, Ceramic disc.	276015
C-21	10-10 μfd, 300 V. electrolytic	234201
C-22	47 μμfd, Ceramic disc.	276479
C-24	.02 μfd, Ceramic disc.	276025
C-25	.01 μfd, Ceramic disc.	276015
C-26	1000-1000 μfd, 30 V. electrolytic	231200
C-27	100 μfd, 250 V. electrolytic	204201
C-28	100 μfd, 250 V. electrolytic	204201
C-29	30-30-30 μfd, 375 V. electrolytic	235306
C-30	.005 μfd, Ceramic disc.	276054
C-31	150 μμfd, Ceramic disc.	276158
C-32	150 μμfd, Ceramic disc.	276158
C-33	.0022 Tubular	295006
C-34	.0022 Tubular	295006
C-35	.01 Tubular	295005
C-36	10-10 μfd, 300 V. electrolytic	234201
C-37	.005 μfd, Ceramic disc.	276054
C-38	.05 μfd, Ceramic disc.	275506
C-40	.02 μfd, Ceramic disc.	276025
C-41	.02 μfd, Ceramic disc.	276025
C-42	.0025 μfd, Ceramic disc.	277257
C-43	.05 μfd, Ceramic disc.	275506
C-45	.02 μfd, Ceramic disc.	296053
C-46	.05 μfd, Ceramic disc.	275506
C-47	.15 μfd, Standup type	209005

CAPACITORS (Cont'd)

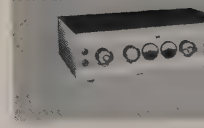
Symbol Number	Description	Part Number
C-48	.15 μfd, Standup type	209005
C-49	.05 μfd, Ceramic disc.	275506
C-50	.02 μfd, Ceramic disc.	296053
C-52	.05 μfd, Ceramic disc.	275506
C-53	.02 μfd, Ceramic disc.	276025
C-54	.0025 μfd, Ceramic disc.	277257
C-55	.02 μfd, Ceramic disc.	276025
C-57	.05 μfd, Ceramic disc.	275506
C-58	.005 μfd, Ceramic disc.	276054
C-59	10-10 μfd, 300 V. electrolytic	234201
C-60	15-130 μμfd, Trimmer (yellow dot)	283010
C-61	15-130 μμfd, Trimmer (yellow dot)	283010
C-62	350-1180 μμfd, Trimmer (blue dot)	283009
C-63	350-1180 μμfd, Trimmer (blue dot)	283009
C-64	20 μfd, 350 V. electrolytic	204200
C-65	70-350 μμfd, Trimmer	286054
C-66	70-350 μμfd, Trimmer	286054
C-67	200 μμfd, Ceramic disc.	276027
C-68	200 μμfd, Ceramic disc.	276027
C-69	1400-3055 μμfd, Trimmer (red dot)	283008
C-70	1400-3055 μμfd, Trimmer (red dot)	283008
C-71	1400-3055 μμfd, Trimmer (red dot)	283008
C-72	1400-3055 μμfd, Trimmer (red dot)	283008
C-73	.01 μfd, Ceramic disc.	276015

COILS AND TRANSFORMERS

L-3	Equalization coil	161009
L-4	Equalization coil	161009
L-5	Bias oscillator coil in can	121600
L-6	Peaking Coil	161004
L-7	Peaking Coil	161004
L-8	Peaking Coil	161004
L-9	Peaking Coil	161004
T-1	Power transformer	101416

CONNECTORS

	Pinjack strip for J-1, J-2, J-3 & J-4	502246
J-5	White pinjack	502220
J-6	White pinjack	502220
J-7	Yellow pinjack	502237
J-8	Yellow pinjack	502237
J-9	Red pinjack	502236



CONNECTORS (Cont'd)

Symbol Number	Description	Part Number
☐ J-10	Red pinjack	502236
☐ J-11	Bakelite jack, 3 terminal w/grip nut	502233
☐ J-12	Phone jack	502242
☐ J-13	Phone jack	502241
☐ J-14	Microphone jack	502241
☐ J-15	Microphone jack	502241
	13 pin plugs	502123
☐ AC-1	AC receptacle	502226
☐ AC-2	AC receptacle	502226
☐ P-1	Bakelite plug, 3 pin	502131

FUSE

☐ F-1	½ Amp slo-blo	491013

RECTIFIERS

☐ E-1	Power rectifier	630052
☐ E-2	Power rectifier	630052
☐ E-3	Power rectifier	630052
☐ E-4	Power rectifier	630052
☐ E-5	Power rectifier	630052
☐ E-6	Power rectifier	630052
☐ CR-1	IN34 meter diode	630006
☐ CR-2	IN34 meter diode	630006

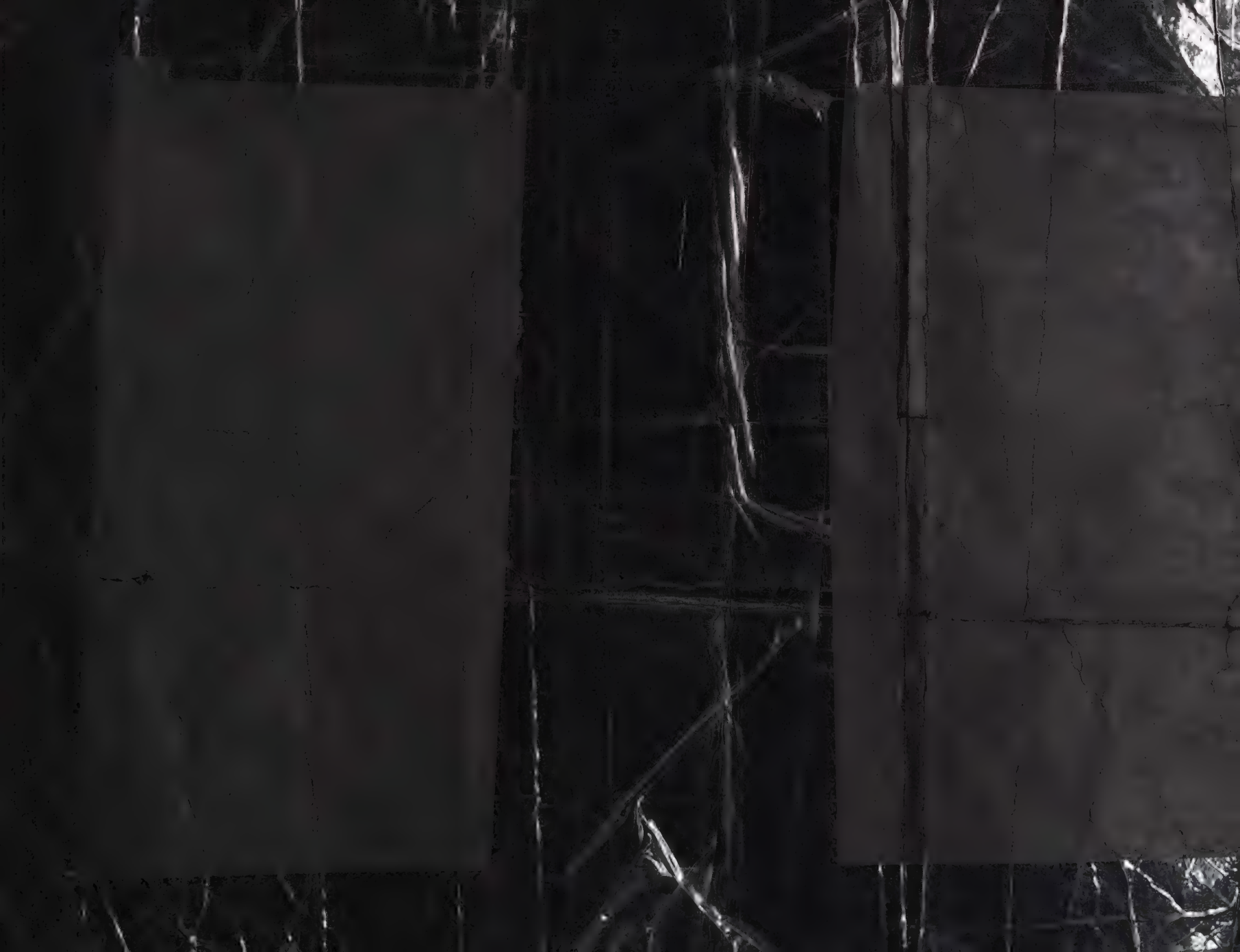
RESISTORS

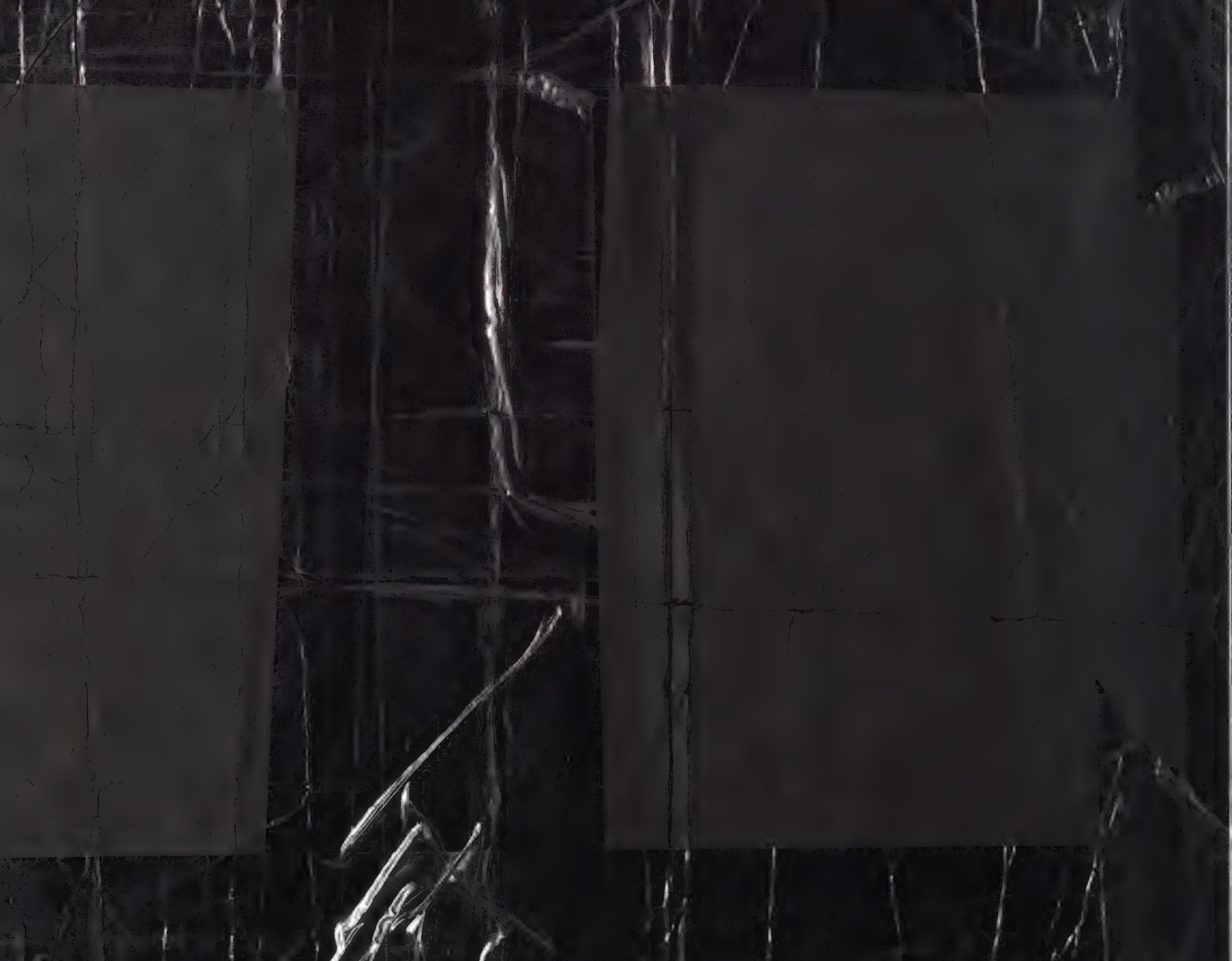
All resistors are ½ watt, 10% tolerance unless otherwise specified.

☐ R-1	10K	301103
☐ R-2	1 meg	301105
☐ R-3	200K, deposited carbon 5%	330016
☐ R-4	2K, 5%	302202
☐ R-5	75K, 5%	302753
☐ R-6	1 meg	301105
☐ R-7	200K, deposited carbon 5%	330016
☐ R-8	33K	301333
☐ R-9	1 meg	301105
☐ R-10	22K	301223
☐ R-11	1.3K 5%	302132
☐ R-12	3.9K	301392
☐ R-13	18K	301183
☐ R-14	1 meg	301105
☐ R-15	47K	301473
☐ R-16	680Ω	301681

RESISTORS (Cont'd)

Symbol Number	Description	Part Number
☐ R-17	3K, 5%	302302
☐ R-18	3K, 5%	302302
☐ R-19	47K	301473
☐ R-20	680Ω	301681
☐ R-21	1 meg	301105
☐ R-22	18K	301183
☐ R-23	3.9K	301392
☐ R-24	1.3K, 5%	302132
☐ R-25	1 meg	301105
☐ R-26	22K	301223
☐ R-27	33K	301333
☐ R-28	200K, deposited carbon 5%	330016
☐ R-29	1 meg	301105
☐ R-30	75K, 5%	302753
☐ R-31	2K, 5%	302202
☐ R-32	1 meg	301105
☐ R-33	200K, deposited carbon 5%	330016
☐ R-34	10K	301103
☐ R-35	1 meg	301105
☐ R-36	1 meg	301105
☐ R-37	4.7 meg	301475
☐ R-38	4.7 meg	301475
☐ R-39	1.2K	301122
☐ R-40	1.2K	301122
☐ R-41	25K, control	390150
☐ R-42	100K	301104
☐ R-43	100Ω	301101
☐ R-44	1K, 5%	302102
☐ R-45	1K, 5%	302102
☐ R-46	10K, 1 watt	304103
☐ R-47	10K, 1 watt	304103
☐ R-48	330Ω, 2 watt	307331
☐ R-49	68K, 2 watt	307683
☐ R-50	22Ω, 1 watt	304220
☐ R-51	2Ω, 5 watt, wire wound	372005
☐ R-52	1 meg, dual control	420013
☐ R-53	4.7 meg	301475
☐ R-54	200K, deposited carbon 5%	330016
☐ R-55	1K, 5%	302102
☐ R-56	400K, deposited carbon 5%	330010
☐ R-57	10 meg	301106
☐ R-58	100K, deposited carbon 5%	330015





RESISTORS (Cont'd)

Symbol Number	Description	Part Number
R-59	22K	301223
R-60	220K	301224
R-61	220K	301224
R-62	220K	301224
R-63	1.5K	301152
R-64	100K	301104
R-65	2.7 Meg	301275
R-66	2K 5%	302202
R-67	56K	301563
R-68	10K	301103
R-69	100K	301104
R-70	100K	301104
R-71	2K 5%	302202
R-72	10K	301103
R-73	56K	301563
R-74	2.7 meg	301275
R-75	1.5K	301152
R-76	100K	301104
R-77	220K	301224
R-78	220K	301224
R-79	220K	301224
R-80	22K	301223
R-81	100K, desposited carbon 5%	330015
R-82	10 meg	301106
R-83	400K, deposited carbon 5%	330010
R-84	1K, 5%	302102
R-85	200K deposited carbon 5%	330016
R-86	4.7 meg	301475
R-87	82K	301823
R-88	82K	301823
R-89	100K	301104
R-90	100K	301104
R-91	250K, ½ watt, dual control	420023
R-92	250K, ½ watt, dual control	420023
R-93	200K, 5%	302204
R-94	200K, 5%	302204
R-95	1 meg, 5%	302105
R-96	1 meg, 5%	302105
R-97	2Ω, 5 watt, wire wound	372005
98	1K	301102
99	1K	301102
100	27K	301273

RESISTORS (Cont'd)

Symbol Number	Description	Part Number
R-101	27K	301273
R-102	100Ω	304101
R-103	470Ω	301471
R-104	100K control	390167
R-105	100K control	390167

SWITCHES

S-1	Selector switch	432305
S-2	Monitor switch	431505
S-3	MULT, NORMAL, ECHO switch	431504
S-4	Speed equalization switch	431505
S-5	Power switch	431200
S-6	Bias switch	431301

TERMINAL STRIPS

TS-1		440203
TS-2		440304
TS-3		440303
TS-4		440506
TS-5		440101
TS-6		440102
TS-7		440402
TS-8		440402
TS-9		440605
TS-10		440501
TS-11		440203
TS-13		440501
TS-14		442301
TS-15		442301

TUBES

V-1	12AX7/ECC83/7025	611012
V-2	12AT7	611013
V-3	12AX7/ECC83/7025	611012
V-4	12AT7	611013
V-5	12AX7/ECC83/7025	611012
V-6	12AT7	611013
V-7	12AX7/ECC83/7025	611012
V-8	12AT7	611013
V-9	12BH7	611004

WIRE, SOLDER AND TUBING

Description	Quantity	Part Number
☐ 70″ Bare wire	1	806070
☐ 25″ Bare wire, heavy	1	806400
☐ 2″ Red	20	801002
☐ 3″ Orange	8	801003
☐ 4″ Yellow	13	801004
☐ 5″ Green	4	801005
☐ 6″ Blue	5	801006
☐ 7″ Violet	4	801007
☐ 8″ Gray	1	801008
☐ 9″ White	3	801009
☐ 10″ Brown	3	801010
☐ 12″ White/red	4	801012
☐ 13″ White/orange	1	801013
☐ 2½″ White/green, stranded	3	804094
☐ 3½″ White/black, stranded	3	804093
☐ 4¼″ White/red, stranded	1	804091
☐ 6″ White/brown, stranded	1	804044
☐ 6″ Green, stranded	1	804038
☐ 6″ Blue, stranded	1	804039
☐ 6″ White, stranded	1	804042
☐ 7½″ Brown, stranded	1	804109
☐ 9″ Red, stranded	1	804086
☐ 10½″ Yellow, stranded	1	804111
☐ 11″ White/black, stranded	1	804087
☐ 12″ White/red, stranded	1	804088
☐ 20 ft. Red shielded cable	1	803059
☐ 26 ft. Gray shielded cable	1	803086
☐ 3 ft. 2 Conductor shielded cable	1	804131
☐ 25 ft. Solder	1	930005
☐ 45″ Black tubing	1	812001
☐ 8″ Yellow tubing	1	812021
☐ 7″ Red tubing	1	812007

MISCELLANEOUS

☐ Bracket	1	470399
☐ Bushing, line cord	1	880013
☐ Chassis	1	470398
☐ Circuit board, playback	1	820111
☐ Circuit board, record	1	820112
☐ Clamp, cable	3	880011
☐ Cord, line	1	802004

MISCELLANEOUS (Cont'd)

Description	Quantity	Part Number
☐ Cover, back	1	461371
☐ Cover, top	1	470400
☐ Decal, record	1	724015
☐ Foot	4	880016
☐ Grommet, ¼″	7	830001
☐ Grommet, ⅜″	6	830200
☐ Insulator for jack strip	1	850060
☐ Knob, large, level control	3	763200
☐ Knob, selector switch	1	763201
☐ Knob, small, level control	3	763003
☐ Knob, tapered	2	764535
☐ Lamp, neon, NE-2H	1	640013
☐ Lamp, pilot, #47	2	640002
☐ Manual, instruction	1	750241
☐ Meter, left	1	659203
☐ Meter, right	1	659204
☐ Panel, control	1	480014
☐ Panel, sub	1	462307
☐ Plate, bottom	1	463308
☐ Plate, capacitor mounting	2	501541
☐ Saddle, tube shield	1	511001
☐ Shield, bias	1	470397
☐ Shield, equalization	1	470396
☐ Shield, playback input	1	470243
☐ Shield, record light	1	850062
☐ Shield	1	470395
☐ Shield, tube	8	510004
☐ Shield, tube (V-9)	1	510013
☐ Socket pilot lamp	2	501730
☐ Socket, tube, chassis mounting	1	501190
☐ Socket, tube, circuit board mounting	8	501698
☐ Stand-off	3	850077
☐ Template, paper, for S-3	1	850058
☐ Tie, cable	2	880026

HARDWARE

NUTS

☐ #3-48	10	570110
☐ #4-40	14	570221
☐ #6-32	30	570340
☐ ¼″-32	3	570940
☐ ⅜″-32	12	570840

PARTS LIST

HARDWARE (Cont'd)

Symbol Description	Quantity	Part Number
MACHINE SCREWS		
☐ #3-48 x 1/4"	10	560112
☐ #4-40 x 1/4"	34	560222
☐ #6-32 x 1/4"	26	560342
☐ #6-32 x 3/8"	5	560344
☐ #6-32 x 1/4" Spade bolt	2	568342
☐ #4-40 x 1/4" Spade bolt	2	568345
SELF-TAPPING SCREWS		
☐ #4 x 1/4"	15	569292
☐ #6 x 5/16"	4	562393
SOLDER LUGS		
☐ #6, internal tooth	5	553005
WASHERS		
☐ 3/8" Fiber washer, with shoulder	4	591701
☐ 3/8" Fiber washer, flat	6	590704
☐ 1/4" lockwasher for R-41	1	587900
☐ #4 lockwasher	4	582200
☐ #6 lockwasher	29	582300

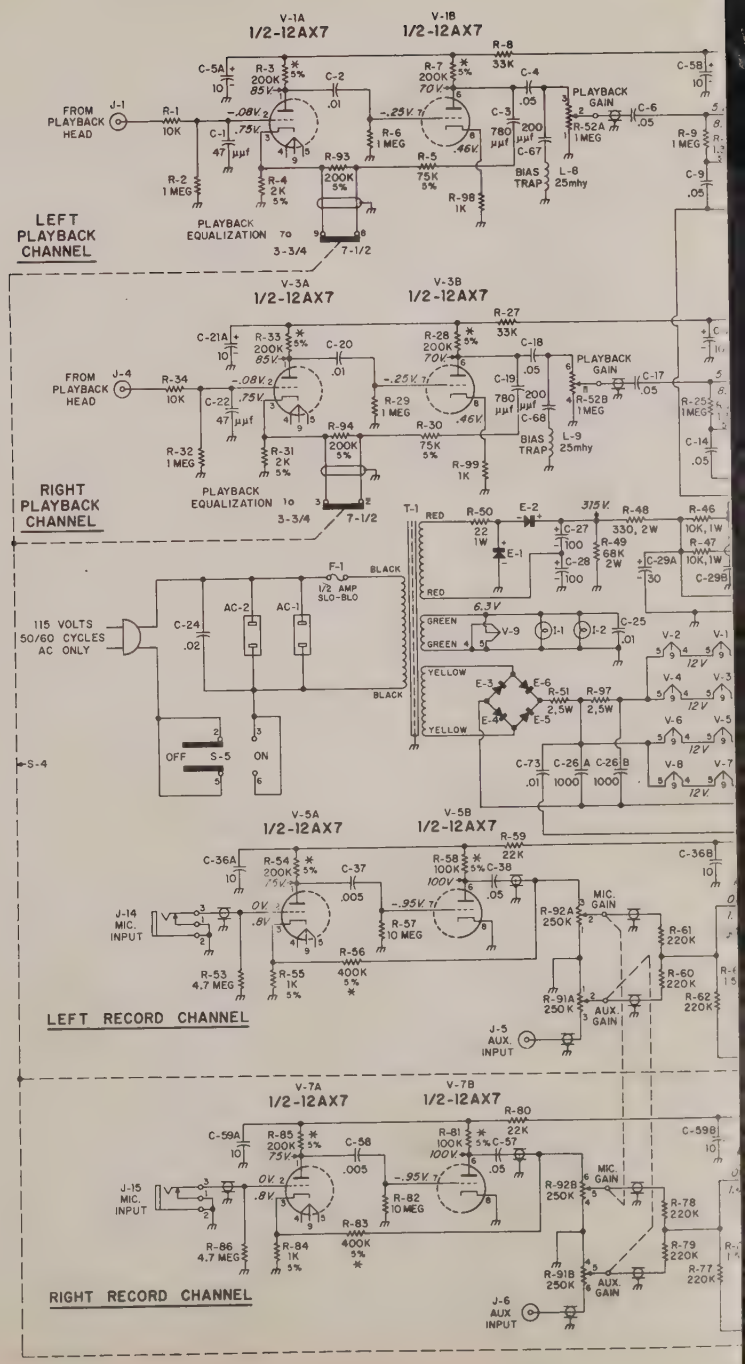
TOOLS NEEDED FOR CONSTRUCTION

Stock No.	Description	Cost*
☐ 46N852	Soldering iron, pencil type	$5.78
☐ 50N132	Long-nose pliers, 6"	2.10
☐ 50N133	Diagonal cutters, 5"	1.84
☐ 45N378	Screwdriver, 6" with 1/4" blade	.64

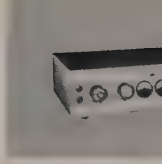
ACCESSORIES YOU MAY WANT

☐ 38K124	Book "Recorder & Tape Recording"	$ 2.95
☐ 99H856	36" Coaxial connecting cable with pin plugs	.71
☐ 49W472	Special low capacity cable 20 μμfd per ft.	.057
☐ 35DX783	Carrying case for transport & tape preamp	24.95
☐ 83YX936	Cover for Tape Preamp	4.95
☐ 83Y940	Switch adapter for two head transports.	
☐ 59J153	Stereophonic headphones (crystal)	23.37
☐ 94S097	KN4500 microphone	24.95
☐ 92R940	Mylar long play tape, 7" reel	3.33
☐ 92R905	Editing tap, 150' roll	.59
☐ 41H553	Phone plug, 1/2" barrel	.44
☐ 96R194	7" reel empty with indexing box	.50
☐ 96R379	Tape splicer	1.50

*Subject to change



SCHEMATIC DIAGRAM

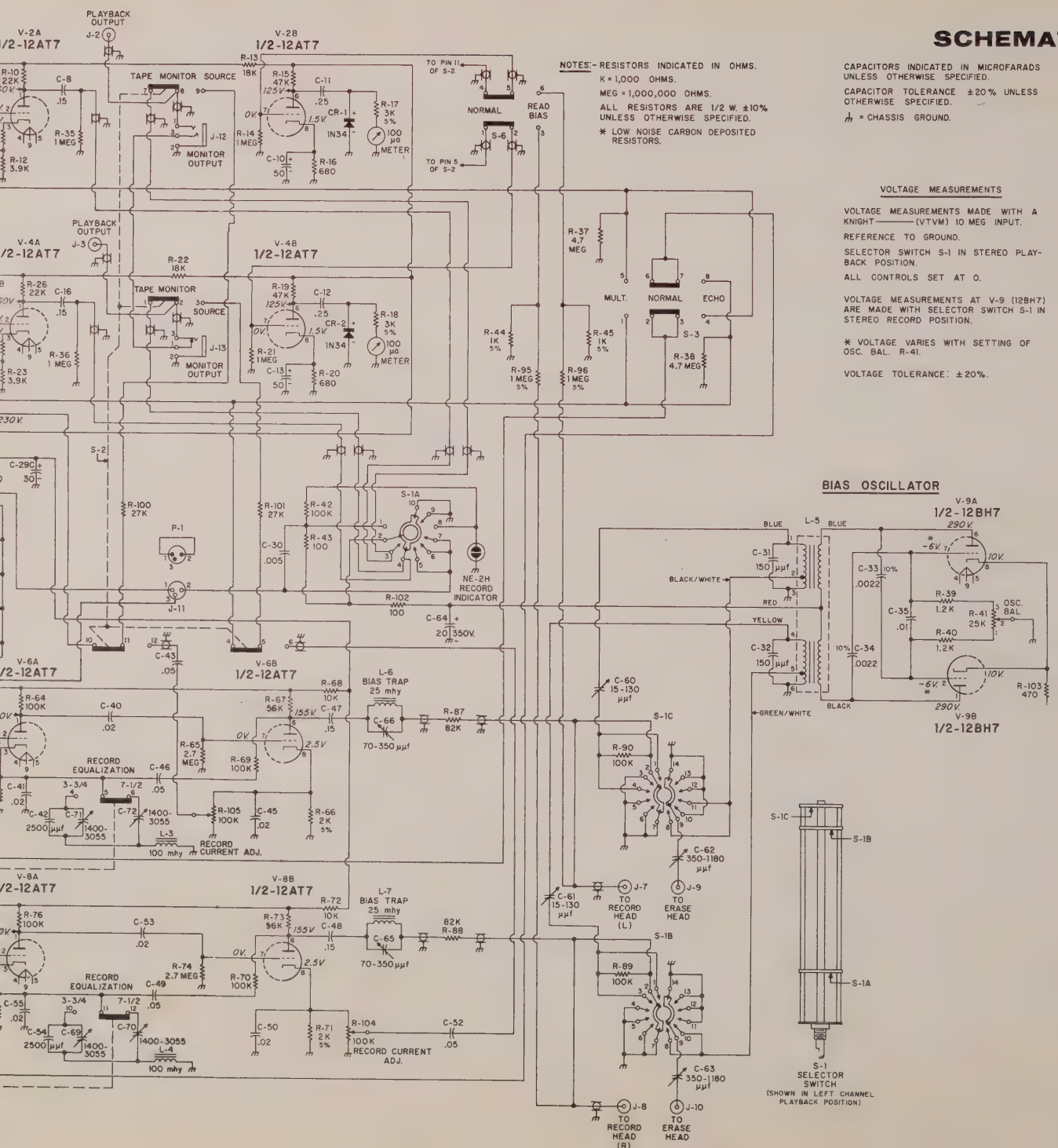


NOTES:- RESISTORS INDICATED IN OHMS.
K = 1,000 OHMS.
MEG = 1,000,000 OHMS.
ALL RESISTORS ARE 1/2 W. ±10% UNLESS OTHERWISE SPECIFIED.
* LOW NOISE CARBON DEPOSITED RESISTORS.

CAPACITORS INDICATED IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
CAPACITOR TOLERANCE ±20% UNLESS OTHERWISE SPECIFIED.
⏚ = CHASSIS GROUND.

VOLTAGE MEASUREMENTS

VOLTAGE MEASUREMENTS MADE WITH A KNIGHT ——— (VTVM) 10 MEG INPUT.
REFERENCE TO GROUND.
SELECTOR SWITCH S-1 IN STEREO PLAY-BACK POSITION.
ALL CONTROLS SET AT 0.
VOLTAGE MEASUREMENTS AT V-9 (12BH7) ARE MADE WITH SELECTOR SWITCH S-1 IN STEREO RECORD POSITION.
* VOLTAGE VARIES WITH SETTING OF OSC. BAL. R-41.
VOLTAGE TOLERANCE: ±20%.



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BIAS OSCILLATOR

V-2A 1/2-12AT7 · V-2B 1/2-12AT7 · V-4A 1/2-12AT7 · V-4B 1/2-12AT7 · V-6A 1/2-12AT7 · V-6B 1/2-12AT7 · V-8A 1/2-12AT7 · V-8B 1/2-12AT7 · V-9A 1/2-12BH7 · V-9B 1/2-12BH7

PLAYBACK OUTPUT J-2 · PLAYBACK OUTPUT J-3 · TAPE MONITOR SOURCE · TAPE MONITOR SOURCE · MONITOR OUTPUT J-12 · MONITOR OUTPUT J-13 · METER · METER

TO PIN 11 OF S-2 · TO PIN 5 OF S-2 · NORMAL · READ BIAS · S-6

MULT. · NORMAL · ECHO · S-3

S-1A · S-1B · S-1C · S-2 · P-1 · J-11 · NE-2H RECORD INDICATOR

L-3 100 mhy · L-4 100 mhy · L-5 · L-6 BIAS TRAP 25 mhy · L-7 BIAS TRAP 25 mhy

RECORD EQUALIZATION · RECORD CURRENT ADJ. · RECORD CURRENT ADJ.

OSC. BAL

BLUE · BLACK/WHITE · RED · YELLOW · GREEN/WHITE · BLACK

J-7 TO RECORD HEAD (L) · J-8 TO RECORD HEAD · J-9 TO ERASE HEAD · J-10 TO ERASE HEAD

S-1 SELECTOR SWITCH (SHOWN IN LEFT CHANNEL PLAYBACK POSITION)

KNIGHT-KITS ARE YOUR BEST BUY THE FINEST ELECTRONIC EQUIPMENT IN KIT FORM. CREATIVE ENGINEERING AND USE OF PREMIUM QUALITY PARTS ASSURE SUPERIOR PERFORMANCE. THAT'S WHY KNIGHT-KITS ARE SOLD WITH THIS EXCLUSIVE GUARANTEE: *EVERY KNIGHT-KIT MUST MEET PUBLISHED SPECIFICATIONS OR WE REFUND YOUR MONEY.*

KNIGHT-KITS ARE "CONVENIENCE ENGINEERED" RESISTORS ARE CARD MOUNTED AND IDENTIFIED. WIRE IS PRECUT. SMALL PARTS ARE PACKAGED IN SEE-THROUGH PLASTIC BAGS. DETAILS SUCH AS THESE AND STEP-BY-STEP INSTRUCTION MANUALS MAKE KNIGHT-KITS EASIEST TO BUILD.

KNIGHT-KITS ARE THE FIRST CHOICE OF EXACTING BUILDERS OF ELECTRONIC KITS EVERYWHERE AND HAVE BEEN SINCE THE EARLY 20's. THERE IS AN OUTSTANDING KNIGHT-KIT AVAILABLE FOR EVERY REQUIREMENT. EACH IS A REWARDING ADVENTURE IN KIT CONSTRUCTION. YOU WILL BE PROUD TO BUILD AND OWN A KNIGHT-KIT.

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